

**SEARCH REQUEST FORM****Scientific and Technical Information Center**

Requester's Full Name: Jonathan Crepeau Examiner #: 75637 Date: 10/9/07  
 Art Unit: 1746 Phone Number 305 081 Serial Number: 09/548823  
 Mail Box and Bldg/Room Location: CP3 7E01 Results Format Preferred (circle): PAPER DISK E-MAIL

**If more than one search is submitted, please prioritize searches in order of need.**

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Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: FUEL CELL ANODE CONFIGURATION FOR CO TOLERANCE

Inventors (please provide full names): Francisco Uribe; Thomas Zawadzinski

Earliest Priority Filing Date: 5/3/01

*\*For Sequence Searches Only\* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

A material which is disclosed as useful ~~for~~ catalyzing carbon monoxide oxidation in a hydrogen-rich gas (e.g. a fuel cell reformat), the material consisting of elemental Cu, Fe, Co, Tb, W, Mo, <sup>Sn</sup><sub>A</sub> oxides thereof, or combinations thereof.

10

\*\*\*\*\*

**STAFF USE ONLY**

	Type of Search	Vendors and cost where applicable
Searcher: <u>ES</u>	NA Sequence (#) _____	STN <u>\$170.77</u>
Searcher Phone #: _____	AA Sequence (#) _____	Dialog _____
Searcher Location: _____	Structure (#) <u>1</u>	Questel/Orbit _____
Date Searcher Picked Up: _____	Bibliographic <u>5</u>	Dr. Link _____
Date Completed: <u>10-10-03</u>	Litigation _____	Lexis/Nexis _____
Searcher Prep & Review Time: <u>5</u>	Fulltext _____	Sequence Systems _____
Clerical Prep Time: _____	Patent Family _____	WWW/Internet _____
Online Time: <u>85</u>	Other _____	Other (specify) _____

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FILE 'REGISTRY' ENTERED AT 15:44:12 ON 10 OCT 2003

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FILE 'REGISTRY' ENTERED AT 15:05:04 ON 10 OCT 2003

L1 E COPPER/CN  
1 SEA COPPER/CN  
E IRON/CN  
L2 1 SEA IRON/CN  
E COBALT/CN  
L3 1 SEA COBALT/CN  
E TERBIUM/CN  
L4 1 SEA TERBIUM/CN  
E TUNGSTEN/CN  
L5 1 SEA TUNGSTEN/CN  
E MOLYBDENUM/CN  
L6 1 SEA MOLYBDENUM/CN  
E TIN/CN  
L7 1 SEA TIN/CN  
L8 1420 SEA ((CU OR FE OR CO OR TB OR W OR MO OR SN) (L) O) /ELS  
(L) 2/ELC.SUB  
E CARBON MONOXIDE/CN  
L9 1 SEA "CARBON MONOXIDE" /CN

FILE 'HCA' ENTERED AT 15:12:08 ON 10 OCT 2003

L10 37525 SEA FUELCELL? OR FUEL? (2A) (CELL OR CELLS)  
L11 QUE CAT# OR CATALY?  
L12 169139 SEA L9 OR CARBON# (A) MONOXIDE# OR CO (2A) (GAS## OR  
GASEOUS? OR GASIF? OR ATM# OR ATMOS? OR STREAM? OR FLOW  
OR FLOWS OR FLOWED OR FLOWING# OR APPLY? OR APPLICATION?  
OR APPLIED OR INTRODUC? OR TREAT? OR PRETREAT? OR  
PROCESS? OR INJECT? OR SYRING? OR JET OR JETS OR NEEDL?)

FILE 'REGISTRY' ENTERED AT 15:14:08 ON 10 OCT 2003

L13 E HYDROGEN/CN  
1 SEA HYDROGEN/CN  
E OXYGEN/CN  
L14 1 SEA OXYGEN/CN

FILE 'HCA' ENTERED AT 15:14:30 ON 10 OCT 2003

L15 732258 SEA L13 OR HYDROGENA? OR H2 OR (HYDROGEN# OR H) (2A) (GAS##  
OR GASEOUS? OR GASIF? OR ATM# OR ATMOS? OR STREAM? OR  
FLOW OR FLOWS OR FLOWED OR FLOWING# OR APPLY? OR  
APPLICATION? OR APPLIED OR INTRODUC? OR TREAT? OR  
PRETREAT? OR PROCESS? OR INJECT? OR SYRING? OR JET OR  
JETS OR NEEDL?)

L16 1284987 SEA L14 OR OXYGENA? OR O2 OR (OXYGEN# OR O) (2A) (GAS## OR  
 GASEOUS? OR GASIF? OR ATM# OR ATMOS? OR STREAM? OR FLOW  
 OR FLOWS OR FLOWED OR FLOWING# OR APPLY? OR APPLICATION?  
 OR APPLIED OR INTRODUC? OR TREAT? OR PRETREAT? OR  
 PROCESS? OR INJECT? OR SYRING? OR JET OR JETS OR NEEDL?)  
 OR AIR  
 L17 444366 SEA L1  
 L18 377957 SEA L2  
 L19 156302 SEA L3  
 L20 21949 SEA L4  
 L21 81058 SEA L5  
 L22 106359 SEA L6  
 L23 83097 SEA L7  
 L24 174236 SEA L8  
 L25 270 SEA L10 AND L11 AND L12 AND L15 AND L16  
 L26 31 SEA L25 AND L17  
 L27 17 SEA L25 AND L18  
 L28 20 SEA L25 AND L19  
 L29 2 SEA L25 AND L20  
 L30 6 SEA L25 AND L21  
 L31 9 SEA L25 AND L22  
 L32 3 SEA L25 AND L23  
 L33 23 SEA L25 AND L24  
 L34 3689 SEA PEM OR P(W)E(W)M OR POLYM? (3A)ELECTROLY? (3A)MEMBRAN?  
 L35 104030 SEA (OXIDA? OR OXIDI? OR OXIDN#) (2A) (CAT# OR CATALY?)  
 L36 4 SEA L26 AND L34  
 L37 16 SEA L26 AND L35  
 L38 1 SEA L28 AND L34  
 L39 10 SEA L28 AND L35  
 L40 6 SEA L33 AND L34  
 L41 14 SEA L33 AND L35  
 L42 18 SEA L10 AND L11 AND L15 AND L16 AND L34 AND L35  
 L43 8 SEA L42 AND ((L17 OR L18 OR L19 OR L20 OR L21 OR L22 OR  
 L23 OR L24))  
 L44 14 SEA L26 AND L28  
 L45 38525 SEA REFORM? OR RE(W)FORM?  
 L46 6 SEA L43 AND L45  
 L47 20 SEA L26 AND L45  
 L48 9 SEA L28 AND L45  
 L49 7 SEA L27 AND L45  
 L50 17 SEA L33 AND L45  
 L51 30 SEA L29 OR L30 OR L31 OR L32 OR L36 OR L38 OR L40 OR L43  
 OR L46 OR L48 OR L49  
 L52 27 SEA (L27 OR L37 OR L39 OR L41 OR L44 OR L50) NOT L51  
 L53 8 SEA (L33 OR L47) NOT (L51 OR L52)

=> file hca

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=&gt; d l51 1-30 cbib abs hitstr hitind

B.D.

L51 ANSWER 1 OF 30 HCA COPYRIGHT 2003 ACS on STN

139:199933 Selective **catalytic** oxidation of CO in **fuel**

**cell** applications using microfibrinous encapsulated **catalyst** structures. Chang, Bong-Kyu; Chen, Laiyuan; Tatarchuk, Bruce J. (Center for Microfibrinous Materials Manufacturing, Department of Chemical Engineering, Auburn University, Auburn, AL, 36849-5127, USA). Annual Meeting Archive - American Institute of Chemical Engineers, Indianapolis, IN, United States, Nov. 3-8, 2002, 2613-2626. American Institute of Chemical Engineers: New York, N. Y. (English) 2002. CODEN: 69DXW7.

AB The sintered microfibrinous materials technol. developed in the lab. is examd. for application to selective **catalytic** oxidn. of CO in simulated **fuel cell** gas environment. The overall objective is to develop a novel **catalyst** material for effective removal of small amts. (1-2%) of CO present in the H<sub>2</sub>-rich gas produced by partial oxidn. or steam **reforming** of hydrocarbons for **fuel cell** applications. The study is divided into two distinct parts. First, the most effective **catalyst** formulation(s) are identified, based upon screening of various metal/support combinations and prepn. techniques. The 2nd part of the study focuses on incorporation of identified **catalysts** into the sintered microfibrinous materials technol., with emphasis on adaptation of conventional prepn. methods for microfibrinous materials. The performance of prepd. microfibrinous **catalyst** is compared to conventional **catalyst** materials.

IT 7440-48-4, Cobalt, uses

(, plain and with gold, supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrinous encapsulated **catalyst** structures)

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 1333-74-0, Hydrogen (H<sub>2</sub>), uses

(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrinous encapsulated **catalyst** structures)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, reactions

(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, **Carbon monoxide**, reactions  
(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67

ST **catalysis** selective oxidn CO **fuel cell**  
microfibrous encapsulated **catalyst**; oxide **catalyst**  
support promoter **carbon monoxide fuel cell** cleanup

IT **Fuel cells**  
(CO removal from **hydrogen stream** for;  
selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

IT Y zeolites  
(gold and ruthenium support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

IT Microfibers  
(network in **catalyst** composite; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

IT Oxides (inorganic), uses  
(promoters; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

IT **Catalyst** supports  
(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

IT Oxidation **catalysts**  
(selective; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

IT Zeolite 13X

## Zeolite 4A

(support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)

- IT 7440-48-4, Cobalt, uses  
(, plain and with gold, supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 1344-43-0, Manganese oxide (MnO), uses  
(CeO<sub>2</sub>- supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 7440-22-4, Silver, uses  
(Co<sub>3</sub>O<sub>4</sub> -supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 7440-05-3, Palladium, uses  
(Fe<sub>2</sub>O<sub>3</sub> - and mixed ceria-titania supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 12612-41-8, Hopcalite  
(**catalyst** and support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 1307-96-6, Cobalt oxide (CoO), uses  
(ceria- supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 1314-13-2, Zinc oxide (ZnO), uses 11129-60-5, Manganese oxide (MnOx)  
(gold support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 1317-38-0, Copper oxide, uses  
(mixed oxide with CeO<sub>2</sub>; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 1306-38-3, Cerium oxide (CeO<sub>2</sub>), uses  
(mixed oxides with CuO, CoO, or MnO, platinum support with TiO<sub>2</sub>; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 7440-18-8, Ruthenium, uses  
(plain and with platinum, supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 7440-06-4, Platinum, uses  
(plain and with ruthenium, supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrous encapsulated **catalyst** structures)
- IT 18282-10-5, Tin dioxide (SnO<sub>2</sub>)

- (platinum support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 124-38-9, Carbon dioxide, uses  
(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 1333-74-0, Hydrogen (H<sub>2</sub>), uses  
(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 7782-44-7, Oxygen, reactions  
(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 630-08-0, Carbon monoxide, reactions  
(selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 1308-06-1, Cobalt oxide (Co<sub>3</sub>O<sub>4</sub>)  
(silver support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 7440-02-0, Nickel, uses  
(sintered microfibrrous encapsulation net; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 7631-86-9, Silica, uses 13463-67-7, Titanium oxide (TiO<sub>2</sub>), uses  
(support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 7440-57-5, Gold, uses  
(supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 7440-45-1, Cerium, uses  
(with gold, manganese oxide-supported; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 1309-37-1, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), uses  
(.alpha.-, support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)
- IT 1344-28-1, Aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), uses  
(.gamma.-, support; selective **catalytic** oxidn. of CO in **fuel cell** applications using microfibrrous encapsulated **catalyst** structures)

**fuel cell** and battery use. Lefebvre, Mark C.

(USA). U.S. Pat. Appl. Publ. US 2003069129 A1 20030410, 15 pp.

(English). CODEN: USXXCO. APPLICATION: US 2001-973490 20011009.

AB Methods of making an oxygen redn. **catalyst** are described in which carbon black, one or more metal-contg. and/or nitrogen-contg. precursor(s) are provided to a reaction zone, and the carbon black is rendered **catalytically** active. To form this **catalytic** activity, the carbon black and one or more metal-contg. and/or nitrogen-contg. precursor(s) are introduced to a reaction zone heated to a temp. of 600-1000.degree., and maintained together in the reaction zone for a cumulative time between 5 s and 240 min.

IT 7439-98-7, Molybdenum, uses 7439-98-7D,  
Molybdenum, salts  
(methods of producing oxygen redn. **catalyst** for  
**fuel cell** and battery use)

RN 7439-98-7 HCA

CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

RN 7439-98-7 HCA

CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

IT 630-08-0, Carbon monoxide, processes

1333-74-0, Hydrogen, processes

7782-44-7, Oxygen, processes

(methods of producing oxygen redn. **catalyst** for  
**fuel cell** and battery use)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{-C}\equiv\text{O}^+$

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$\text{O}=\text{O}$

IC ICM B01J021-18



ICS H01M004-96  
NCL 502180000; 502182000; 502183000; 502184000; 502185000; 429044000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67, 72  
ST **fuel cell** cathode **catalyst** oxygen redn  
IT Primary batteries  
    (Zn-air; methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT Reduction **catalysts**  
    (electrochem.; methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT Electric furnaces  
    (induction; methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT Macrocyclic compounds  
    (metal; methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT Battery cathodes  
    **Fuel cell** cathodes  
    **Fuel cells**  
Furnaces  
Reducing agents  
    (methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT Actinide compounds  
Actinides  
Alkali metal salts  
Alkali metals, uses  
Alkaline earth metals  
Alkaline earth salts  
Rare earth metals, uses  
Rare earth salts  
Transition metal salts  
Transition metals, uses  
    (methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT Carbon black, uses  
    (methods of producing oxygen redn. **catalyst** for **fuel cell** and battery use)  
IT 57-13-6D, Urea, salts 75-05-8D, Acetonitrile, salts 302-01-2D, Hydrazine, salts 7439-89-6, Iron, uses 7439-89-6D, Iron, salts 7439-96-5, Manganese, uses 7439-96-5D, Manganese, salts 7439-98-7, Molybdenum, uses 7439-98-7D, Molybdenum, salts 7440-02-0, Nickel, uses 7440-02-0D, Nickel, salts 7440-16-6, Rhodium, uses 7440-16-6D, Rhodium, salts 7440-18-8, Ruthenium, uses 7440-18-8D, Ruthenium, salts 7440-47-3, Chromium, uses 7440-47-3D, Chromium, salts 7440-48-4, Cobalt, uses 7440-48-4D, Cobalt, salts 7440-50-8, Copper, uses 7440-50-8D, Copper, salts 7440-62-2, Vanadium, uses 7440-62-2D, Vanadium, salts 7440-66-6, Zinc, uses 7440-66-6D, Zinc, salts 7664-41-7, Ammonia, uses

- (methods of producing oxygen redn. **catalyst** for  
**fuel cell** and battery use)
- IT 630-08-0, **Carbon monoxide**, processes  
1333-74-0, **Hydrogen**, processes  
7782-44-7, **Oxygen**, processes  
(methods of producing oxygen redn. **catalyst** for  
**fuel cell** and battery use)
- IT 7782-50-5P, **Chlorine**, preparation  
(methods of producing oxygen redn. **catalyst** for  
**fuel cell** and battery use)
- IT 7440-37-1, **Argon**, uses 7440-59-7, **Helium**, uses 7727-37-9,  
**Nitrogen**, uses  
(methods of producing oxygen redn. **catalyst** for  
**fuel cell** and battery use)
- L51 ANSWER (3) OF 30 HCA COPYRIGHT 2003 ACS on STN B.D.  
138:287174 Potential Application of Tungsten Carbides as  
Electrocatalysts: 4. Reactions of Methanol, Water, and  
**Carbon Monoxide** over Carbide-Modified W(110).  
Hwu, Henry H.; Chen, Jingguang G. (University of Delaware, Newark,  
DE, 19716, USA). Journal of Physical Chemistry B, 107(9), 2029-2039  
(English) 2003. CODEN: JPCBFK. ISSN: 1520-6106. Publisher:  
American Chemical Society.
- AB The reactions of methanol, water, and **carbon  
monoxide** over clean and carbide-modified W(110) are studied  
by temp.-programmed desorption, high-resoln. electron energy loss  
spectroscopy, and Auger electron spectroscopy. The product  
selectivity of methanol on unmodified W(110) is 67.5% toward  
complete decompn., 8.5% toward CO, and 24% toward CH<sub>4</sub>. After the  
W(110) surface is modified by carbon, the complete decompn. pathway  
decreases to 58%, with the remaining methanol dissocg. to produce  
approx. equal amts. of CO and CH<sub>4</sub>. On W(110), the no. of H<sub>2</sub>O mols.  
undergoing dissocn. is detd. to be 0.320 water mols. per W atom.  
Upon carbon modification, the activity of water decreases by half to  
0.153 mols. per W atom. The study of CO on W(110) shows three  
reaction pathways: decompn. to surface C and O, formation  
of **gas**-phase CO<sub>2</sub>, and mol. desorption at 284 and 335 K.  
On the C/W(110) surface, only 7% of the adsorbed CO decompn. to  
produce surface C and O; addnl., no CO<sub>2</sub> desorption is detected. The  
preadsorption of water onto C/W(110) does not appear to affect the  
amt. of CO adsorption, but does lead to CO desorbing at the lower  
temp. of 271 K. These results are compared to our previous studies  
on W(111) and C/W(111) to det. the effect of substrate structure on  
the reaction pathways of methanol, water, and CO.
- IT 7440-33-7, **Tungsten**, uses 7440-33-7D, **Tungsten**,  
carbide-modified  
(reactions of methanol, water, and **carbon  
monoxide** over carbide-modified tungsten studied by  
temp.-programmed desorption, HREELS, and Auger electron  
spectroscopy)
- RN 7440-33-7 HCA  
CN Tungsten (8CI, 9CI) (CA INDEX NAME)

W

RN 7440-33-7 HCA  
CN Tungsten (8CI, 9CI) (CA INDEX NAME)

W

IT 630-08-0, **Carbon monoxide**, reactions  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

 $\text{-C}\equiv\text{O}^+$ 

IT 1333-74-0; Hydrogen, formation (nonpreparative)  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

CC 22-8 (Physical Organic Chemistry)  
Section cross-reference(s): 66, 67, 73

ST methanol water **carbon monoxide** reaction carbide  
modified tungsten HREELS

IT Isotope effect  
(deuterium; reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)

IT **Catalysts**  
(electrocatalysts, potential application of tungsten carbides as **fuel cell** electrocatalysts; reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)

IT Electron energy loss spectroscopy  
(high-resoln.; reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)

- IT Adsorption  
(of **carbon monoxide**; reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT Adsorbed substances  
Auger electron spectra  
Decomposition  
Decomposition **catalysts**  
Molecular vibration  
Surface reaction  
Vibrational frequency  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT Desorption  
(thermal, temp.-programmed; reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT 7440-33-7, Tungsten, uses 7440-33-7D, Tungsten, carbide-modified  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT 67-56-1, Methanol, reactions 630-08-0, **Carbon monoxide**, reactions 811-98-3, Methanol-d4 1849-29-2, Methan-d3-ol 7732-18-5, Water, reactions 7789-20-0, Water-d2  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT 74-82-8, Methane, formation (nonpreparative) 1333-74-0, Hydrogen, formation (nonpreparative)  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT 2143-68-2, Methoxy 7263-60-7, Methoxy-d3  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)
- IT 7782-39-0, Deuterium, properties  
(reactions of methanol, water, and **carbon monoxide** over carbide-modified tungsten studied by temp.-programmed desorption, HREELS, and Auger electron spectroscopy)

Bad filing date  
no good from me.

- 137:355019 Hydrogen purification apparatus for removal of **carbon monoxide** from **reforming** gas.. Taguchi, Kiyoshi; Ukai, Kunihiro; Fujiwara, Seiji; Tomizawa, Takeshi; Wakita, Hidenobu (Matsushita Electric Industrial Co., Ltd., Japan). PCT Int. Appl. WO 2002090248 A1 20021114, 47 pp. DESIGNATED STATES: W: CN, KR, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR. (Japanese). CODEN: PIXXD2. APPLICATION: WO 2002-JP4229 20020426. PRIORITY: JP 2001-136625 20010507; JP 2001-210427 20010711.
- AB The title app. comprises a **reforming** gas supply section for supplying H- and CO-contg. **reforming gas**, an oxidizing gas supply section for mingling an oxidizing gas into the **reforming** gas, and a **catalyst** purifn. element. The **catalyst** purifn. element includes a 1st **catalyst** selected from Pt, Pd, Ru and Rh, a 2nd **catalyst** selected from Pd, Ru, Rh and Ni, and the 1st and 2nd **catalysts** are mixed or combined in one piece; wherein an alumina or a zeolite, which is ion-exchanged with a 1st period transition metal (i.e., Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, or Zn), is used as the heat-resistant **catalyst** support base material, and the **catalyst** element is in the form of pellets or a honeycomb structure. The **catalyst** purifn. element may include 2 sections; the temps. of the **catalyst** purifn. element and **H gas** are detected, resp.; and the supply of the oxidizing gas is controlled. The purified H can be used as **fuel** for **fuel cells**.
- IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses (catalyst contg.; hydrogen purifn. app. for removal of **carbon monoxide** from **reforming** gas)
- RN 7439-89-6 HCA
- CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)
- Fe
- RN 7440-48-4 HCA
- CN Cobalt (8CI, 9CI) (CA INDEX NAME)
- Co
- IT 1333-74-0P, Hydrogen, preparation (hydrogen purifn. app. for removal of **carbon monoxide** from **reforming** gas)
- RN 1333-74-0 HCA
- CN Hydrogen (8CI, 9CI) (CA INDEX NAME)
- H-H
- IT 7782-44-7, **Oxygen**, reactions (oxidizing **gas** contg.; hydrogen purifn. app.)

for removal of **carbon monoxide** from  
**reforming gas**)

RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, **Carbon monoxide,**  
**processes**  
(removal of; **hydrogen** purifn. app. for removal of  
**carbon monoxide** from **reforming gas**)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM C01B003-32  
ICS C01B003-40; B01J023-46; B01J023-89; H01M008-06  
CC 49-1 (Industrial Inorganic Chemicals)  
Section cross-reference(s): 51, 52, 67  
ST hydrogen purifn app **carbon monoxide** removal  
**reforming gas catalyst; fuel**  
**cell hydrogen purifn app reforming gas**  
IT Zeolites (synthetic), uses  
(**catalyst** support; hydrogen purifn. app. for removal of  
**carbon monoxide** from **reforming gas**)  
IT **Catalyst supports**  
**Catalysts**  
Water gas shift reaction **catalysts**  
(hydrogen purifn. app. for removal of **carbon**  
**monoxide** from **reforming gas**)  
IT **Fuel cells**  
(hydrogen purifn. app. for removal of **carbon**  
**monoxide** from **reforming gas** for)  
IT 7439-89-6, Iron, uses 7439-96-5, Manganese, uses  
7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4,  
Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium,  
uses 7440-20-2, Scandium, uses 7440-32-6, Titanium, uses  
7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses  
7440-50-8, Copper, uses 7440-62-2, Vanadium, uses 7440-66-6,  
Zinc, uses  
(**catalyst** contg.; hydrogen purifn. app. for removal of  
**carbon monoxide** from **reforming gas**)  
IT 1344-28-1, Alumina, uses  
(**catalyst** support; hydrogen purifn. app. for removal of  
**carbon monoxide** from **reforming gas**)  
IT 1333-74-0P, Hydrogen, preparation  
(hydrogen purifn. app. for removal of **carbon**  
**monoxide** from **reforming gas**)  
IT 7782-44-7, Oxygen, reactions

(oxidizing gas contg.; hydrogen purifn. app.  
for removal of carbon monoxide from  
reforming gas)

IT 630-08-0, Carbon monoxide,  
processes

(removal of; hydrogen purifn. app. for removal of  
carbon monoxide from reforming gas)

L51 ANSWER 5 OF 30 HCA COPYRIGHT 2003 ACS on STN

137:281654 Fuel processor and method for generating hydrogen for  
fuel cells. Ahmed, Shabbir; Lee, Sheldon; Carter;

John; Krumpelt, Michael (University of Chicago, USA). PCT Int.

Appl. WO 2002076883 A1 20021003, 50 pp. DESIGNATED STATES: W: AE,

AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR,

CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU,

ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV,

MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD,

SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU,

ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ,

CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU,

MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN:

PIXXD2. APPLICATION: WO 2002-US4685 20020207. PRIORITY: US

2001-816676 20010323.

AB A method of producing a H<sub>2</sub> rich gas stream includes  
supplying an O<sub>2</sub> rich gas, steam, and fuel to an inner  
reforming zone of a fuel processor that includes a partial  
oxidn. catalyst and a steam reforming  
catalyst or a combined partial oxidn. and stream  
reforming catalyst. The method also includes  
contacting the O<sub>2</sub> rich gas, steam, and fuel with the  
partial oxidn. catalyst and the steam reforming  
catalyst or the combined partial oxidn. and stream reforming  
catalyst in the inner reforming zone to generate a  
hot reformat stream. The method still further includes  
cooling the hot reformat stream in a cooling zone to  
produce a cooled reformat stream. Addnl., the method  
includes removing sulfur-contg. compds. from the cooled  
reformat stream by contacting the cooled reformat  
stream with a sulfur removal agent. The method still further  
includes contacting the cooled reformat stream with a  
catalyst that converts water and carbon  
monoxide to carbon dioxide and H<sub>2</sub> in a  
water-gas-shift zone to produce a final reformat stream  
in the fuel processor.

IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses  
(fuel processor and method for generating hydrogen for  
fuel cells)

RN 7439-89-6 HCA

CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

*water shift*

RN 7440-48-4 HCA  
CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 1333-74-0P, **Hydrogen**, preparation  
(fuel **processor** and method for generating hydrogen for  
**fuel cells**)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IC ICM C01B003-32  
ICS C01B003-38; C01B003-48; C01B003-58; B01J008-04; C01B003-40  
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)  
ST hydrogen generation **fuel cell**  
IT **Catalyst** supports  
**Fuel cells**  
Steam **reforming catalysts**  
Water gas shift reaction **catalysts**  
(fuel **processor** and method for generating hydrogen for  
**fuel cells**)  
IT Oxidation **catalysts**  
(partial; fuel **processor** and method for generating hydrogen for  
**fuel cells**)  
IT 7440-54-2, Gadolinium, uses  
(ceria doped with; fuel **processor** and method for generating  
hydrogen for **fuel cells**)  
IT 7439-88-5, Iridium, uses 7439-89-6, Iron, uses  
7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4,  
Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium,  
uses 7440-22-4, Silver, uses 7440-48-4, Cobalt, uses  
7440-50-8, Copper, uses 7440-57-5, Gold, uses 12160-53-1,  
Gallium lanthanum oxide (GaLaO<sub>3</sub>) 12597-68-1, Stainless steel, uses  
(fuel **processor** and method for generating hydrogen for  
**fuel cells**)  
IT 1333-74-0P, **Hydrogen**, preparation  
(fuel **processor** and method for generating hydrogen for  
**fuel cells**)  
IT 1314-13-2, Zinc oxide, uses  
(fuel **processor** and method for generating hydrogen for  
**fuel cells**)  
IT 7704-34-9, Sulfur, processes  
(fuel **processor** and method for generating hydrogen for  
**fuel cells**)  
IT 1306-38-3, Ceria, uses  
(gadolinium-doped, **catalyst** support; fuel **processor** and  
method for generating hydrogen for **fuel cells**)



L51 ANSWER (6) OF 30 HCA COPYRIGHT 2003 ACS on STN  
137:265520 **Carbon monoxide poisoning of**

*Bad date (declaration)*

**catalysts in polymer electrolyte fuel cells.** Muller, Bernd (Gustavsburg, Germany). Fortschritt-Berichte VDI, Reihe 6: Energietechnik, 466, i-x, 1-114 (German) 2001. CODEN: FVENFU. ISSN: 0178-9414. Publisher: VDI Verlag GmbH.

AB The **H<sub>2</sub>-rich gas**, produced from fossil fuels by the **reforming process**, for **fuel cell** application contained low amts. of the **catalyst** poisoning CO. The poisoning of the **catalyst** by CO suppressed the anodic **H<sub>2</sub> oxidn.** and decreased the performance of the **polymer membrane electrolyte fuel cell (PEFC)** significantly. The tech. potential to improve the CO tolerance of the PEFC was investigated theor., and the results were verified exptl. by the measurement of current/voltage curves. The CO poisoning of the **catalyst** was detd. by electrochem. impedance spectroscopy, and by the developed impedance model it was possible to sep. the potential differences of the single components. This procedure allowed the description of the phys. and electrochem. processes at the anode of the PEFC during CO poisoning. The increase of the cell temp. increased the CO tolerance of the Pt-anode, and by **air**-bleeding the CO could be oxidized, while the use of CO-tolerant electrodes was accompanied with lower current densities.

IT 7439-98-7, Molybdenum, uses  
(**carbon monoxide poisoning of catalysts in polymer electrolyte fuel cells**)

RN 7439-98-7 HCA

CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

IT 1333-74-0, **Hydrogen**, uses  
(**fuel gas contg.; carbon monoxide poisoning of catalysts in polymer electrolyte fuel cells**)

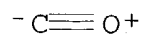
RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, **Carbon monoxide**,  
**processes**  
(**hydrogen fuel gas contg. impurities of; carbon monoxide poisoning of catalysts in polymer electrolyte fuel cells**)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67, 72, 76
- ST **carbon monoxide poisoning fuel**  
**cell anode oxidn catalyst**
- IT Current density  
Electric current-potential relationship  
**Fuel cell anodes**  
Poisoning, **catalytic**  
(**carbon monoxide poisoning of**  
**catalysts in polymer electrolyte fuel**  
**cells**)
- IT **Oxidation catalysts**  
(electrochem.; **carbon monoxide poisoning of**  
**catalysts in polymer electrolyte fuel**  
**cells**)
- IT Polyoxyalkylenes, uses  
(fluorine- and sulfo-contg., ionomers; **carbon**  
**monoxide poisoning of catalysts in polymer**  
**electrolyte fuel cells**)
- IT **Fuel gases**  
(**hydrogen with CO impurities; carbon**  
**monoxide poisoning of catalysts in polymer**  
**electrolyte fuel cells**)
- IT **Fuel cells**  
(polymer membrane; **carbon monoxide poisoning**  
**of catalysts in polymer electrolyte fuel**  
**cells**)
- IT Fluoropolymers, uses  
(polyoxyalkylene-, sulfo-contg., ionomers; **carbon**  
**monoxide poisoning of catalysts in polymer**  
**electrolyte fuel cells**)
- IT Ionomers  
(polyoxyalkylenes, fluorine- and sulfo-contg.; **carbon**  
**monoxide poisoning of catalysts in polymer**  
**electrolyte fuel cells**)
- IT Electric impedance  
(spectroscopy; **carbon monoxide poisoning of**  
**catalysts in polymer electrolyte fuel**  
**cells**)
- IT 7439-98-7, Molybdenum, uses 7440-06-4, Platinum, uses  
7440-18-8, Ruthenium, uses 12714-36-2 60501-15-7  
(**carbon monoxide poisoning of**  
**catalysts in polymer electrolyte fuel**  
**cells**)
- IT 1333-74-0, Hydrogen, uses  
(fuel gas contg.; **carbon monoxide**

poisoning of **catalysts** in polymer electrolyte  
**fuel cells**)

IT 630-08-0, Carbon monoxide,  
processes

(hydrogen fuel gas contg. impurities of;  
**carbon monoxide** poisoning of **catalysts**  
in polymer electrolyte **fuel cells**)

*work shift*

L51 ANSWER (7) OF 30 HCA COPYRIGHT 2003 ACS on STN

137:265379 Generation of hydrogen by fuel **reforming** for  
**fuel cells**. Ahmed, Shabbir; Krumpelt, Michael

(University of Chicago, USA). PCT Int. Appl. WO 2002076882 A2  
20021003, 26 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ,  
BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ,  
EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ,  
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY,  
KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY,  
DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT,  
SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO  
2002-US3690 20020207. PRIORITY: US 2001-816694 20010323.

AB A H<sub>2</sub>-rich gas is generated by **reforming** a fuel  
mixt. consisting of mol. oxygen (**air**), fuel, and water in  
the presence of an autothermally **reforming**  
**catalyst** at 400-700.degree.C. The fuel can be methane,  
natural gas, propane, ethanol, liquefied petroleum gas, gasoline,  
kerosene, and diesel. The **catalyst** contains a transition  
metal, such as Pt, Pd, Ru, Rh, Ir, Fe, Co, Ni, Cu, Ag, or Au and an  
oxide ion-conducting ceramic material crystd. in a fluorite  
structure or LaGaO<sub>3</sub>. The obtained H<sub>2</sub>-rich gas is brought  
into contact with a second **catalyst** to convert CO and H<sub>2</sub>O  
into CO<sub>2</sub> and H<sub>2</sub>. The second **catalyst** consists  
of a transition metal, such as Pt, Pd, Ni, Ir, Rh, Co, Cu, Ag, Au,  
Ru, or Fe, on ceria or ceria doped with a rare earth or alk. earth  
element, such as Gd, Sm, Y, La, Pr, Mg, Ca, Sr, or Ba.

IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses  
(generation of hydrogen by fuel **reforming** for  
**fuel cells**)

RN 7439-89-6 HCA

CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 1333-74-0P, Hydrogen, preparation

(generation of hydrogen by fuel **reforming** for  
**fuel cells**)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
(generation of hydrogen by fuel **reforming** for  
**fuel cells**)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C $\equiv$ O+

IC ICM C01B003-02  
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)  
Section cross-reference(s): 52, 67

ST hydrogen manuf hydrocarbon fuel **reforming catalyst**  
**fuel cell**

IT Natural gas, reactions  
(fuel; generation of hydrogen by fuel **reforming** for  
**fuel cells**)

IT Petroleum products  
(gases, liquefied, fuel; generation of hydrogen by fuel  
**reforming for fuel cells**)

IT Diesel fuel  
**Fuel cells**  
**Reforming catalysts**  
(generation of hydrogen by fuel **reforming** for  
**fuel cells**)

IT Gasoline  
Kerosene  
(generation of hydrogen by fuel **reforming** for  
**fuel cells**)

IT Fuel gas manufacturing  
(**reforming**; generation of hydrogen by fuel  
**reforming for fuel cells**)

IT 7439-91-0, Lanthanum, uses 7439-95-4, Magnesium, uses 7440-10-0,  
Praseodymium, uses 7440-19-9, Samarium, uses 7440-24-6,  
Strontium, uses 7440-39-3, Barium, uses 7440-54-2, Gadolinium,  
uses 7440-65-5, Yttrium, uses 7440-70-2, Calcium, uses  
(dopant; generation of hydrogen by fuel **reforming** for  
**fuel cells**)

IT 64-17-5, Ethanol, reactions 67-63-0, Iso-propanol, reactions  
71-23-8, n-Propanol, reactions 71-43-2, Benzene, reactions  
74-82-8, Methane, reactions 74-84-0, Ethane, reactions 74-85-1,  
Ethylene, reactions 74-98-6, Propane, reactions 106-97-8,  
Butane, reactions 108-88-3, Toluene, reactions 109-66-0,  
Pentane, reactions 110-54-3, Hexane, reactions 110-82-7,

★

Cyclohexane, reactions 115-07-1, Propene, reactions 287-92-3, Cyclopentane 540-84-1, Iso-octane 1330-20-7, Xylene, reactions 25167-67-3, Butene 25377-72-4, Pentene 35296-72-1, Butanol (fuel; generation of hydrogen by fuel **reforming** for **fuel cells**)

IT 1306-38-3, Ceria, uses 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 7440-57-5, Gold, uses 12160-53-1, Gallium lanthanum oxide  $\text{GaLaO}_3$  (generation of hydrogen by fuel **reforming** for **fuel cells**)

IT 124-38-9, Carbon dioxide, formation (nonpreparative) (generation of hydrogen by fuel **reforming** for **fuel cells**)

IT 1333-74-0P, Hydrogen, preparation (generation of hydrogen by fuel **reforming** for **fuel cells**)

IT 630-08-0, Carbon monoxide, reactions 7732-18-5, Water, reactions (generation of hydrogen by fuel **reforming** for **fuel cells**)

L51 ANSWER (8) OF 30 HCA COPYRIGHT 2003 ACS on STN

137:203942 Platinum group metal promoted copper oxidation **catalysts** and methods for **carbon monoxide**

remediation. Shore, Lawrence; Ruettinger, Wolfgang F.; Farrauto, Robert J. (USA). U.S. Pat. Appl. Publ. US 2002122764 A1 20020905, 18 pp., Cont.-in-part of U.S. Ser. No. 771,812. (English). CODEN: USXXCO. APPLICATION: US 2001-35525 20011109. PRIORITY: US 2000-669044 20000925; US 2001-771812 20010129.

AB The invention provides processes for selectively oxidizing **carbon monoxide** from an input gas stream that contains **carbon monoxide**, oxygen and hydrogen. The process includes the step of contacting the input gas stream with a preferential **oxidn. catalyst**. The preferential **oxidn. catalysts** are copper-based **catalysts** contg. low concns. of platinum group metals. In some embodiments, the processes of the invention are conducted using preferential **oxidn. catalysts** having an oxide support on which is dispersed copper or an oxide thereof, a platinum group metal and a reducible metal oxide. In other embodiments, the processes of the invention are conducted with a preferential **oxidn. catalysts** having a cerium oxide support on which is dispersed copper or an oxide thereof and a platinum group metal. The method is useful for removing **carbon monoxide** from **hydrogen feed streams** for proton exchange membrane (PEM) **fuel cells**.

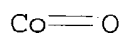
IT 1307-96-6, Cobalt oxide, uses 1313-27-5, Molybdenum oxide, uses 7440-50-8, Copper, uses

has Pt  
~~total~~ ~~good~~ ~~quest~~ ~~stand~~ ~~date~~  
parent app viewed  
does not have Pp  
catalyst

(platinum group metal promoted copper oxidn.  
**catalysts** and methods for **carbon**  
**monoxide** remediation)

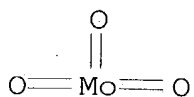
RN 1307-96-6 HCA

CN Cobalt oxide (CoO) (8CI, 9CI) (CA INDEX NAME)



RN 1313-27-5 HCA

CN Molybdenum oxide (MoO3) (7CI, 8CI, 9CI) (CA INDEX NAME)



RN 7440-50-8 HCA

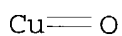
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)



IT 1317-38-0, Copper oxide (CuO), uses  
(platinum group metal promoted copper oxidn.  
**catalysts** and methods for **carbon**  
**monoxide** remediation)

RN 1317-38-0 HCA

CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)



IT 1333-74-0, Hydrogen, miscellaneous 7782-44-7,  
Oxygen, miscellaneous  
(platinum group metal promoted copper oxidn.  
**catalysts** and methods for **carbon**  
**monoxide** remediation)

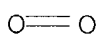
RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)



RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

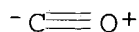


IT 630-08-0, Carbon monoxide, processes  
(platinum group metal promoted copper oxidn.

**catalysts and methods for carbon  
monoxide remediation)**

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



- IC ICM C01B031-20  
NCL 423437200  
CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST **fuel cell hydrogen purifn carbon  
monoxide removal catalyst**  
IT **Oxidation catalysts**  
Steam  
(platinum group metal promoted copper oxidn.  
**catalysts and methods for carbon  
monoxide remediation)**
- IT Platinum-group metals  
Zeolites (synthetic), uses  
(platinum group metal promoted copper oxidn.  
**catalysts and methods for carbon  
monoxide remediation)**
- IT Petroleum products  
Petroleum **reforming**  
(**reformates**; platinum group metal promoted copper  
oxidn. **catalysts and methods for carbon  
monoxide remediation)**
- IT 1302-88-1, Cordierite 1306-38-3, Cerium oxide, uses  
1307-96-6, Cobalt oxide, uses 1313-13-9, Manganese oxide,  
uses 1313-27-5, Molybdenum oxide, uses 1313-97-9,  
Neodymium oxide 1313-99-1, Nickel oxide, uses 1314-13-2, Zinc  
oxide, uses 1314-23-4, Zirconia, uses 1314-62-1, Vanadium oxide,  
uses 1344-28-1, Alumina, uses 7439-88-5, Iridium, uses  
7440-04-2, Osmium, uses 7440-05-3, Palladium, uses 7440-06-4,  
Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium,  
uses 7440-50-8, Copper, uses 7631-86-9, Silica, uses  
11118-57-3, Chromium oxide 12036-32-7, Praseodymium oxide  
13463-67-7, Titania, uses  
(platinum group metal promoted copper oxidn.  
**catalysts and methods for carbon  
monoxide remediation)**
- IT 1317-38-0, Copper oxide (CuO), uses  
(platinum group metal promoted copper oxidn.  
**catalysts and methods for carbon  
monoxide remediation)**
- IT 1333-74-0, Hydrogen, miscellaneous 7782-44-7,  
Oxygen, miscellaneous  
(platinum group metal promoted copper oxidn.  
**catalysts and methods for carbon  
monoxide remediation)**
- IT 64-19-7, Acetic acid, reactions 3251-23-8 39374-75-9, Platinum

hydroxide

(platinum group metal promoted copper oxidn.  
**catalysts** and methods for **carbon**  
**monoxide** remediation)

IT 630-08-0, **Carbon monoxide**, processes  
(platinum group metal promoted copper oxidn.  
**catalysts** and methods for **carbon**  
**monoxide** remediation)

L51 ANSWER (9) OF 30 HCA COPYRIGHT 2003 ACS on STN  
137:188274 **Fuel cell** anode configuration for  
**carbon monoxide** tolerance. Uribe, Francisco A.;  
Zawodzinski, Thomas A. (USA). U.S. Pat. Appl. Publ. US 2002119363  
A1 20020829, 11 pp., Cont.-in-part of U.S. Ser. No. 216,313,  
abandoned. (English). CODEN: USXXCO. APPLICATION: US 2001-848823  
20010503. PRIORITY: US 1998-216313 19981218.

AB A polymer electrolyte **fuel cell** (PEFC) is  
designed to operate on a **reformat** fuel stream  
contg. **oxygen** and dild. hydrogen fuel with CO impurities.  
A **polymer electrolyte membrane** has an  
electrocatalytic surface formed from an electrocatalyst mixed with  
the polymer and bonded on an anode side of the membrane. An anode  
backing is formed of a porous elec. conductive material and has a  
first surface abutting the electrocatalytic surface and a second  
surface facing away from the membrane. The second surface has an  
**oxidn. catalyst** layer effective to  
**catalyze** the **oxidn.** of CO by oxygen present in the  
fuel stream where at least the layer of **oxidn.**  
**catalyst** is formed of a non-precious metal **oxidn.**  
**catalyst** selected from the group consisting of Cu, Fe, Co,  
Tb, W, Mo, Sn, and oxides thereof, and other metals having at least  
two low oxidn. states.

IT 7439-89-6, Iron, uses 7439-98-7, Molybdenum, uses  
7440-27-9, Terbium, uses 7440-31-5, Tin, uses  
7440-33-7, Tungsten, uses 7440-48-4, Cobalt, uses  
7440-50-8, Copper, uses  
(**fuel cell** anode configuration for  
**carbon monoxide** tolerance)

RN 7439-89-6 HCA  
CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

RN 7439-98-7 HCA  
CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

RN 7440-27-9 HCA  
CN Terbium (8CI, 9CI) (CA INDEX NAME)

INSTANT APP



Tb

RN 7440-31-5 HCA  
CN Tin (8CI, 9CI) (CA INDEX NAME)

Sn

RN 7440-33-7 HCA  
CN Tungsten (8CI, 9CI) (CA INDEX NAME)

W

RN 7440-48-4 HCA  
CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

RN 7440-50-8 HCA  
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0, Hydrogen, uses  
(fuel cell anode configuration for  
carbon monoxide tolerance)  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, miscellaneous  
(impurity; fuel cell anode configuration for  
carbon monoxide tolerance)  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

 $\text{-C}\equiv\text{O}^+$ 

IC ICM H01M004-90  
ICS H01M004-92; H01M008-10  
NCL 429042000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST fuel cell anode configuration carbon  
monoxide tolerance

- IT **Catalysts**  
(electrocatalysts; **fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT **Oxidation catalysts**  
(electrochem.; **fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT **Fuel cell anodes**  
Solid state **fuel cells**  
(**fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT Oxides (inorganic), uses  
(**fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT **Polymer electrolytes**  
(membrane; **fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT **Fuel gases**  
(reformate; **fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT 7439-89-6, Iron, uses 7439-98-7, Molybdenum, uses 7440-06-4, Platinum, uses 7440-27-9, Terbium, uses 7440-31-5, Tin, uses 7440-33-7, Tungsten, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 12779-05-4  
(**fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT 1333-74-0, Hydrogen, uses  
(**fuel cell** anode configuration for **carbon monoxide** tolerance)
- IT 630-08-0, **Carbon monoxide**, miscellaneous  
(impurity; **fuel cell** anode configuration for **carbon monoxide** tolerance)

L51 ANSWER (10) OF 30 HCA COPYRIGHT 2003 ACS on STN  
 137:111597 Steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub>  
**catalyst**: a kinetic analysis and strategies for suppression  
 of CO formation. Agrell, Johan; Birgersson, Henrik; Boutonnet,  
 Magali (Department of Chemical Engineering and Technology, KTH-Royal  
 Institute of Technology, Chemical Technology, Stockholm, SE-100 44,  
 Swed.). Journal of Power Sources, 106(1-2), 249-257 (English) 2002.  
 CODEN: JPSODZ. ISSN: 0378-7753. Publisher: Elsevier Science B.V..  
 AB Steam reforming of methanol (CH<sub>3</sub>OH+H<sub>2</sub>O CO<sub>2</sub>+3H<sub>2</sub>) was studied over a  
 com. Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst** for prodn. of hydrogen onboard  
 proton exchange membrane (PEM) **fuel cell**  
 vehicles. A simple power-law rate expression was fitted to exptl.  
 data to predict the rates of CO<sub>2</sub> and H<sub>2</sub> formation under  
 various reaction conditions. The apparent activation energy (E<sub>a</sub>)  
 was estd. to be 100.9 kJ mol<sup>-1</sup>, in good agreement with values  
 reported in the literature. Appreciable amts. of CO byproduct were  
 formed in the reforming process at low contact times and high  
 methanol conversions. Being a **catalyst** poison that  
 deactivates the electrocatalyst at the **fuel cell**

anode at concns. exceeding a few ppm, special attention was paid to the pathways for CO formation and strategies for its suppression. It was found that increasing the steam-methanol ratio effectively decreases CO formation. Likewise, addn. of oxygen or **air** to the steam-methanol mixt. minimizes the prodn. of CO. By shortening the contact time and lowering the max. temp. in the reactor, CO prodn. can be further decreased by suppressing the reverse water-gas shift reaction.

IT 7440-50-8, Copper, uses  
 (steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**  
 and kinetic anal. and strategies for suppression of CO formation)  
 RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 630-08-0, **Carbon monoxide**, processes  
 (steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**  
 and kinetic anal. and strategies for suppression of CO formation)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

IT 7782-44-7, Oxygen, uses  
 (steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**  
 and kinetic anal. and strategies for suppression of CO formation)  
 RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST steam reforming methanol copper zinc oxide **catalyst**  
**fuel cell**  
 IT **Fuel cells**  
 (proton exchange membrane; steam reforming of methanol over a  
 Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst** and kinetic anal. and strategies  
 for suppression of CO formation)  
 IT Steam reforming  
 Steam reforming **catalysts**  
 (steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**  
 and kinetic anal. and strategies for suppression of CO formation)  
 IT 1314-13-2, Zinc oxide, uses 1344-28-1, Alumina, uses  
 7440-50-8, Copper, uses  
 (steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**  
 and kinetic anal. and strategies for suppression of CO formation)  
 IT 630-08-0, **Carbon monoxide**, processes  
 (steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**

- and kinetic anal. and strategies for suppression of CO formation)
- IT 7782-44-7, Oxygen, uses  
(steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> catalyst  
and kinetic anal. and strategies for suppression of CO formation)
- IT 67-56-1, Methanol, uses  
(steam reforming of methanol over a Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> catalyst  
and kinetic anal. and strategies for suppression of CO formation)

L51 ANSWER (11) OF 30 HCA COPYRIGHT 2003 ACS on STN

136:331192 Carbon monoxide-selective oxidation

*Bad date*  
catalysts showing high catalytic activity at low temperature and their preparation. Yonemura, Masanao; Nojima, Shigeru; Yasutake, Akinobu (Mitsubishi Heavy Industries, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002126535 A2 20020508, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-329999 20001030.

AB The oxidn. catalysts capable of selectively oxidizing CO in mixed gases contg. CO, H<sub>2</sub>, and an oxidizing agent of O<sub>2</sub> in PROx (preferential CO oxidn.) devices of polymer electrolyte fuel cells (PEFC), are prepd. by adding catalyst supports in solvents, followed with adding catalyst active components in the solvents. Preferably, the supports are zeolites and in the above-mentioned solvent reaction, alkali metals or H of the zeolites are ion-exchanged with metals of metal salts (catalyst active components). The zeolites may be cryst. silicates, Y-type zeolites, A-type zeolites, .beta.-type zeolites, mordenite, and/or ferrierite. The cryst. silicates may be shown as (1 .+-. 0.8)R<sub>2</sub>O.[aM<sub>2</sub>O<sub>3</sub>.bLO.cAl<sub>2</sub>O<sub>3</sub>].ySiO<sub>2</sub> [R = alkali metal and/or H; M = Group VIII element, rare earth element, Ti, V, Cr, Nb, Sb, and/or Ga; L = Mg, Ca, Sr, and/or Ba; a .gtoreq.0, b = 0-20, a + b = 1, y = 11-3000; having the highest to the 5th highest peaks in the powder X-ray diffraction using CuK.alpha. ray in the lattice spacing of 3.65 .+-. 0.1, 3.75 .+-. 0.1, 3.85 .+-. 0.1, 10.0 .+-. 0.3, and 11.2 .+-. 0.3 .ANG.]. The metal salts may be nitrates, sulfates, chlorides, acetates, or hydroxides of Pt, Ru, Pd, Rh, Ir, Cr, Co, Ni, Cu, Fe, and/or Sn.

IT 7782-44-7, Oxygen, uses  
(oxidizing agent; prepn. of CO-selective oxidn. catalysts supported on zeolites for H fuel prepn.)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 7440-31-5, Tin, uses  
(prepn. of CO-selective oxidn. catalysts supported on zeolites for H fuel prepn.)

RN 7440-31-5 HCA

CN Tin (8CI, 9CI) (CA INDEX NAME)

Sn

IT 630-08-0, **Carbon monoxide**, reactions  
(prepn. of CO-selective oxidn. **catalysts** supported on  
zeolites for H fuel prepn.)  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

 $\text{-C}\equiv\text{O}^+$ 

IT 1333-74-0, **Hydrogen**, uses  
(prepn. of CO-selective oxidn. **catalysts** supported on  
zeolites for H fuel prepn.)  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IC ICM B01J029-70  
ICS B01J029-12; B01J029-22; B01J029-67; B01J029-74; B01J029-76;  
B01J029-78; C10K001-34; H01M008-06; H01M008-10; C01B003-32  
CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction  
Mechanisms)  
Section cross-reference(s): 49, 51  
ST **carbon monoxide** selective oxidn **catalyst**  
prepn; hydrogen fuel prepn **carbon monoxide** oxidn  
removal; zeolite support **carbon monoxide**  
selective oxidn **catalyst**; preferential **carbon**  
**monoxide** oxidn **catalyst** prepn  
IT A zeolites  
Beta zeolites  
Y zeolites  
(**catalyst** support; prepn. of CO-selective oxidn.  
**catalysts** supported on zeolites for H fuel prepn.)  
IT Silicates, uses  
(cryst., **catalyst** support; prepn. of CO-selective  
oxidn. **catalysts** supported on zeolites for H fuel  
prepn.)  
IT **Fuel cells**  
(prepn. of CO-selective oxidn. **catalysts** supported on  
zeolites for H fuel prepn.)  
IT Oxidation **catalysts**  
(selective; prepn. of CO-selective oxidn. **catalysts**  
supported on zeolites for H fuel prepn.)  
IT 124-38-9P, Carbon dioxide, **processes**  
(CO removal as; prepn. of CO-selective oxidn.  
**catalysts** supported on zeolites for H fuel prepn.)  
IT 12173-30-7, Ferrierite 12173-98-7, Mordenite

- (**catalyst** support; prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)
- IT 353275-99-7P, Aluminum calcium iron silicon oxide (Al<sub>1.6</sub>Ca<sub>0.2</sub>Fe<sub>0.5</sub>Si<sub>27057.35</sub>)
- (**catalyst** support; prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)
- IT 7782-44-7, Oxygen, uses (oxidizing agent; prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)
- IT 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-31-5, Tin, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses (prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)
- IT 630-08-0, Carbon monoxide, reactions (prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)
- IT 1333-74-0, Hydrogen, uses (prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)
- IT 7440-06-4, Platinum, uses (supported on zeolites; prepn. of CO-selective oxidn. **catalysts** supported on zeolites for H fuel prepn.)

L51 ANSWER (12) OF 30 HCA COPYRIGHT 2003 ACS on STN W

136:297210 Process for reducing coke formation in hydrocarbon processing by application of radio frequency electromagnetic radiation. Dieckmann, Gunther H.; Moir, Michael E. (Chevron U.S.A. Inc., USA). PCT Int. Appl. WO 2002028770 A1 20020411, 19 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US30924 20010927. PRIORITY: US 2000-PV237298 20001002.

AB A process to suppress the formation of coke during processing of a hydrocarbonaceous material, such as a hydrocarbon conversion processes. Electromagnetic radiation is applied to the hydrocarbonaceous material while the material is heated to >700 degrees F. The frequency of the electromagnetic radiation is preferably <300 MHz. The process is particularly useful in the reforming of a hydrocarbon for conversion in a fuel cell.

- IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses (process for reducing coke formation in hydrocarbon processing by application of radio frequency electromagnetic radiation)

RN 7439-89-6 HCA  
CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

RN 7440-48-4 HCA  
CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 630-08-0P, Carbon monoxide, preparation  
1333-74-0P, Hydrogen, preparation  
(process for reducing coke formation in hydrocarbon  
processing by application of radio frequency electromagnetic  
radiation)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{-C}\equiv\text{O}^+$

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, reactions  
(process for reducing coke formation in hydrocarbon  
processing by application of radio frequency electromagnetic  
radiation)

RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$\text{O}=\text{O}$

IC ICM C01B003-24  
CC 51-6 (Fossil Fuels, Derivatives, and Related Products)  
Section cross-reference(s): 67  
ST hydrocarbon reforming coke catalyst RF radiation  
heating fuel cell  
IT Air  
Fuel cells  
Heating  
Perovskite-type crystals  
Radio wave  
Steam reforming kinetics  
(process for reducing coke formation in hydrocarbon processing by  
application of radio frequency electromagnetic radiation)

- IT Fuel gas manufacturing  
(**reforming**; process for reducing coke formation in hydrocarbon processing by application of radio frequency electromagnetic radiation)
- IT 7439-88-5, Iridium, uses **7439-89-6**, Iron, uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses 7440-04-2, Osmium, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses **7440-48-4**, Cobalt, uses 7440-50-8, Copper, uses  
(process for reducing coke formation in hydrocarbon processing by application of radio frequency electromagnetic radiation)
- IT 74-82-8P, Methane, preparation 124-38-9P, Carbon dioxide, preparation **630-08-0P**, **Carbon monoxide**, preparation **1333-74-0P**, **Hydrogen**, preparation  
(**process** for reducing coke formation in hydrocarbon processing by application of radio frequency electromagnetic radiation).
- IT 71-43-2, Benzene, reactions 108-88-3, Toluene, reactions 110-54-3, Hexane, reactions 7732-18-5, Water, reactions **7782-44-7**, **Oxygen**, reactions  
(**process** for reducing coke formation in hydrocarbon processing by application of radio frequency electromagnetic radiation)

L51 ANSWER **13** OF 30 HCA COPYRIGHT 2003 ACS on STN  
135:154730 Method and **catalyst** for removal of **carbon**

**monoxide** from **hydrogen-rich gas**..

Echigo, Mitsuaki; Suzuki, Minoru; Okada, Osamu (Osaka Gas Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001220108 A2 20010814, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-33494 20000210.

- AB In title method for removing CO from CO-contg. **H-rich** object **gas** to be processed, an oxidant is added to the object gas, and a mainly Cu-contg. CO-removing **catalyst** is used for removal of CO by oxidn. reaction at 100-400.degree.. The mainly Cu-contg. CO-removing **catalyst** may contg. W or Mo at at. ratio Cu : W or Cu : Mo = 1 : 0.002-0.2. The mainly Cu-contg. CO-removing **catalyst** is obtained by firing CuO powder. The CO-contg. **H-rich** object **gas** can be hydrocarbon-reformed gas for **fuel cell**.

- IT **7439-98-7D**, Molybdenum, compd., uses **7440-33-7D**, Tungsten, compd., uses

(**catalyst** contg.; method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)

RN 7439-98-7 HCA

CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

RN 7440-33-7 HCA

CN Tungsten (8CI, 9CI) (CA INDEX NAME)



W

IT 1333-74-0P, Hydrogen, preparation  
(method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, reactions  
(method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)  
RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, Carbon monoxide, processes  
(removal of; method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM C01B003-38  
ICS B01J023-72; B01J023-85; B01J023-88; C10K003-04  
CC 49-1 (Industrial Inorganic Chemicals)  
Section cross-reference(s): 52, 67  
ST **hydrogen rich gas carbon monoxide** removal; **catalyst carbon monoxide** removal gas; cupric oxide **catalyst carbon monoxide** removal; hydrocarbon reformed gas **carbon monoxide** removal; **fuel cell hydrocarbon carbon monoxide** removal  
IT **Fuel cells**  
(**fuel** for; method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas** for)  
IT **Catalysts**  
Oxidizing agents  
(method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)  
IT **Hydrocarbons, reactions**  
(reforming of; method and **catalyst** for removal of

**carbon monoxide from hydrogen-rich gas)**

- IT 1317-38-0, Cupric oxide, uses **7439-98-7D**, Molybdenum, compd., uses **7440-33-7D**, Tungsten, compd., uses 7440-50-8D, Copper, compd., uses 10213-10-2  
(**catalyst** contg.; method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)
- IT 1333-74-0P, Hydrogen, preparation  
(method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)
- IT 7782-44-7, Oxygen, reactions  
(method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)
- IT 1314-13-2, Zinc oxide (ZnO), uses 1344-28-1, Alumina, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses  
(method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas** for)
- IT 630-08-0, **Carbon monoxide**, processes  
(removal of; method and **catalyst** for removal of **carbon monoxide** from **hydrogen-rich gas**)

L51 ANSWER 14 OF 30 HCA COPYRIGHT 2003 ACS on STN

135:109578 Synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen. Iyuke, S. E. (Department of Chemical & Environmental Engineering, Faculty of Engineering, Universiti Putra Malaysia, Selangor, Malay.). Chemical Engineering Research and Design, 79(A2), 209-214 (English) 2001. CODEN: CERDEE. ISSN: 0263-8762. Publisher: Institution of Chemical Engineers.

AB In an attempt to produce hydrogen for a less relatively expensive proton exchange membrane (PEM) **fuel cell** than the present expensive means, the steam reformation of methane was proposed because a steam reformer is a cheap source of hydrogen compared to water electrolysis and other methods. However, the reformer effluent contains about 75% hydrogen and 25% **carbon monoxide** (CO) by vol. Reformation with a good **catalyst** could yield a 1% CO content in the effluent, but 1% CO, which is equiv. to 10,000 ppm CO, has a poisoning effect on the platinum (Pt) **catalysts** of the **PEM fuel cell** electrodes. Since the **catalyst** can only tolerate CO of less than 100 ppm, it is then expedient to introduce a purifn. system to reduce the CO content to the required concn. To achieve this, activated carbon (AC)-SnO<sub>2</sub> adsorbent was synthesized and used in a pressure swing adsorption (PSA) system. Consequently, 34.57% SnCl<sub>2</sub>·2H<sub>2</sub>O salt as a tin ion precursor, was impregnated onto activated carbon to improve its adsorptive interaction with CO. A model H<sub>2</sub>/CO mixt., representing the stoichiometric ratio of H<sub>2</sub> and CO in the steam reformer effluent gas was used. It was obsd. that the amt. of CO adsorbed was almost equal to that desorbed, which implies that the adsorption of CO on the prepd.

*quest. table date  
bad date (decl.)*

adsorbents is reversible. Further exploitation of the impregnated activated carbon in PSA expts. showed that adsorption of **carbon monoxide** was higher with the impregnated carbon than in the pure carbon. Within the limits of anal. error, it was seen that the concn. of **carbon monoxide**, which was 1000 ppm, was successfully reduced to 40.2 and 10.4 ppm by the pure and the impregnated activated carbons, resp. These results confirmed that Sn-activated carbon in the PSA system could be used in the purifn. of hydrogen. The species responsible for the improved **gas phase CO** adsorption with the impregnated carbon was found to be SnO<sub>2</sub>. Consequently, the high adsorptive selectivity of AC-SnO<sub>2</sub> towards **gas phase CO**, when compared to that of the pure carbon, confirms its superiority and applicability in the removal of CO. This phenomenon then indicates a good future for the robustness of this promising adsorbent, since CO remains a major contributor to the current level of the global **air** pollution problems.

IT 18282-10-5, Tin dioxide  
 (synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)  
 RN 18282-10-5 HCA  
 CN Tin oxide (SnO<sub>2</sub>) (8CI, 9CI) (CA INDEX NAME)



IT 1333-74-0, Hydrogen, processes  
 (synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, processes  
 (synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 48, 49  
 ST hydrogen proton exchange membrane **fuel cell**;  
 activated carbon tin dioxide swing adsorption  
 IT Solid state **fuel cells**  
 (proton exchange membrane; synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)  
 IT 18282-10-5, Tin dioxide

(synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)

IT 1333-74-0, **Hydrogen, processes**

(synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)

IT 630-08-0, **Carbon monoxide, processes**

(synthesized tin-activated carbon adsorbent for purer and cheaper hydrogen)

L51 ANSWER (15) OF 30 HCA COPYRIGHT 2003 ACS on STN

135:94667 Method for decreasing **carbon monoxide** content in **hydrogen-containing gas** and **catalyst** thereof.. Hiramatsu, Yasushi (Mitsubishi Gas Chemical Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001199706 A2 20010724, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-8927 20000118. *Bad date*

AB The title method includes contacting **H-contg. gas** contained **CO** with **O2** in the presence of Fe- and Pt-coexisting **catalysts**. The **H-contg. gas** contained **CO** is contacted with 0.5- to 4-fold **O2** at 20-120.degree.. The Fe- and Pt-contg. components are supported on a support. The **H-contg. gas** is manufd. by **reforming** reaction of hydrocarbons or methane to serve as H source of **fuel cell**, etc.

IT 7439-89-6, **Iron, uses**

(**catalyst** contg.; method for decreasing **carbon monoxide** content in **hydrogen-contg. gas** and **catalyst** thereof)

RN 7439-89-6 HCA

CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

IT 1333-74-0P, **Hydrogen, preparation**

(method for decreasing **carbon monoxide** content in **hydrogen-contg. gas** and **catalyst** thereof)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, **Oxygen, reactions**

(method for decreasing **carbon monoxide** content in **hydrogen-contg. gas** and **catalyst** thereof)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, Carbon monoxide, processes  
(removal of; method for decreasing carbon  
monoxide content in hydrogen-contg. gas  
and catalyst thereof)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM C01B003-38

ICS B01J023-89; C10K003-04; H01M008-06

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 51, 52, 67

ST carbon monoxide content decrease  
catalytic oxidn; hydrogen gas  
carbon monoxide content decrease;  
reforming carbon monoxide content  
decrease oxidn; fuel cell hydrogen  
carbon monoxide removal

IT Fuel cells

(fuel for; method for decreasing carbon  
monoxide content in hydrogen-contg. gas  
and catalyst thereof)

IT Hydrocarbons, reactions

(reforming of; method for decreasing carbon  
monoxide content in hydrogen-contg. gas  
and catalyst thereof)

IT 7439-89-6, Iron, uses 7440-06-4, Platinum, uses  
(catalyst contg.; method for decreasing carbon  
monoxide content in hydrogen-contg. gas  
and catalyst thereof)

IT 1333-74-0P, Hydrogen, preparation  
(method for decreasing carbon monoxide  
content in hydrogen-contg. gas and  
catalyst thereof)

IT 7782-44-7, Oxygen, reactions  
(method for decreasing carbon monoxide  
content in hydrogen-contg. gas and  
catalyst thereof)

IT 67-56-1, Methanol, reactions  
(reforming of; method for decreasing carbon  
monoxide content in hydrogen-contg. gas  
and catalyst thereof)

IT 630-08-0, Carbon monoxide, processes  
(removal of; method for decreasing carbon  
monoxide content in hydrogen-contg. gas  
and catalyst thereof)

L51 ANSWER 16 OF 30 HCA COPYRIGHT 2003 ACS on STN

135:63327 Selective partial oxidation reactor for production of hydrogen by hydrocarbon **reforming**.. Matsui, Nobuki; Ikegami, Shuji; Okamoto, Yasunori (Daikin Industries, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001180910 A2 20010703, 10 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-373589 19991228.

AB The title app. includes gas path(s) for partial oxidn. of introduced **gas** to remove **CO** by combustion reaction in the presence of oxidn. **catalyst** in **H2** atm., and a heat exchanger for heat exchanging between introduced gas in the gas path(s) and a heat-transfer medium in a heat-transfer medium path; the oxidn. **catalyst** is arranged on the heat exchanger. The heat exchanger includes Al heat-transfer fins. **Catalyst** films are coated on Al oxidn.-generated Al<sub>2</sub>O<sub>3</sub> layers on the surfaces of the heat exchanger. The **catalyst** can be Ru-, Pt-, Rh-, Au- or Co-based **catalyst**. The heat-transfer medium is **air**. The app. can be used for **fuel cell** system, and water is used for recovery of waste heat from the **fuel cell** system.

IT 7440-48-4, Cobalt, uses  
(**catalyst** contg.; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 1333-74-0P, Hydrogen, preparation  
(prodn. of; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
(selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM C01B003-38

ICS H01M008-06

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 52

ST selective partial oxidn reactor hydrogen prodn; hydrocarbon

- reforming** hydrogen prodn oxidn reactor; **fuel cell** hydrogen prodn oxidn reactor
- IT **Air**  
(heat-transfer medium; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT **Reforming**  
(of hydrocarbon; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT **Oxidation**  
(partial; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT **Waste heat**  
(recovery of; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT **Hydrocarbons, reactions**  
(**reforming** of; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT **Combustion**  
**Fuel cells**  
Heat exchangers  
Heat transfer  
Oxidation **catalysts**  
Reactors  
(selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-48-4, Cobalt, uses 7440-57-5, Gold, uses  
(**catalyst** contg.; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT 1333-74-0P, Hydrogen, preparation  
(prodn. of; selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT 7429-90-5, Aluminum, uses  
(selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT 7732-18-5, Water, uses  
(selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)
- IT 630-08-0, Carbon monoxide, reactions  
(selective partial oxidn. reactor for prodn. of hydrogen by hydrocarbon **reforming**)

L51 ANSWER (17) OF 30 HCA COPYRIGHT 2003 ACS on STN  
135:48609 Process for reducing concentration of carbon  
**monoxide in hydrogen-containing gas**  
using **catalyst**. Takamura, Koki; Hiramatsu, Yasushi  
(Mitsubishi Gas Chemical Company, Inc., Japan). U.S. Pat. Appl.  
Publ. US 2001004453 A1 20010621, 22 pp. (English). CODEN: USXXCO.  
APPLICATION: US 2000-734888 20001213. PRIORITY: JP 1999-363370  
19991221; JP 2000-8928 20000118; JP 2000-33523 20000210; JP  
2000-127553 20000427.

*questionable date  
bad date  
(decl.)*

AB There are disclosed a process for effectively reducing a **carbon monoxide** concn. in a **hydrogen** -contg. **gas** obtained by **reforming** methanol or the like, and a **catalyst** used therefore. In the present invention, **carbon monoxide** in the **hydrogen**-contg. **gas** is contacted with oxygen in the presence of a **catalyst** comprising platinum and at least one metal selected from the group consisting of cobalt, nickel, copper and manganese.

IT 7440-48-4, Cobalt, uses  
(process for reducing concn. of **carbon monoxide** in **hydrogen**-contg. **gas** using **catalyst**)

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 1333-74-0P, Hydrogen, uses  
(process for reducing concn. of **carbon monoxide** in **hydrogen**-contg. **gas** using **catalyst**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, reactions  
(process for reducing concn. of **carbon monoxide** in **hydrogen**-contg. **gas** using **catalyst**)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, Carbon monoxide, processes  
(process for reducing concn. of **carbon monoxide** in **hydrogen**-contg. **gas** using **catalyst**)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM B01J023-42

ICS B01J023-40

NCL 423247000



- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67
- ST **fuel cell hydrogen carbon monoxide lowering catalyst**
- IT **Fuel cells**  
Oxidation  
Oxidation **catalysts**  
(process for reducing concn. of **carbon monoxide**  
in **hydrogen-contg. gas** using **catalyst**  
)
- IT 1344-28-1, Alumina, uses 7429-90-5, Aluminum, uses 7439-96-5,  
Manganese, uses 7440-02-0, Nickel, uses 7440-06-4, Platinum,  
uses **7440-48-4**, Cobalt, uses 7440-50-8, Copper, uses  
7440-66-6, Zinc, uses  
(process for reducing concn. of **carbon monoxide**  
in **hydrogen-contg. gas** using **catalyst**  
)
- IT 1333-74-0P, **Hydrogen**, uses  
(process for reducing concn. of **carbon monoxide** in **hydrogen-contg. gas** using  
**catalyst**)
- IT 7782-44-7, **Oxygen**, reactions  
(process for reducing concn. of **carbon monoxide** in **hydrogen-contg. gas** using  
**catalyst**)
- IT 630-08-0, **Carbon monoxide**, processes  
(process for reducing concn. of **carbon monoxide**  
in **hydrogen-contg. gas** using **catalyst**  
)
- IT 497-19-8, Sodium carbonate, uses 1310-73-2, Sodium hydroxide, uses  
(process for reducing concn. of **carbon monoxide**  
in **hydrogen-contg. gas** using **catalyst**  
)
- L51 ANSWER (18) OF 30 HCA COPYRIGHT 2003 ACS on STN *And sure*  
135:7811 Manufacture of **hydrogen-containing gas** for  
**fuel cells**. Fukunaga, Tetsuya; Takatsu, Kozo;  
Kisen, Tadashi (Idemitsu Kosan Co., Ltd., Japan). Jpn. Kokai Tokkyo  
Koho JP 2001155755 A2 20010608, 9 pp. (Japanese). CODEN: JKXXAF.  
APPLICATION: JP 1999-335625 19991126.
- AB **H-contg. gas** is manufd. by selective oxidn.  
removal of CO followed by contacting with **O2-removing**  
**catalysts** for control of **O2** concn. to .ltoreq.500  
ppm. The **O2-removing catalysts** may be Pt, Cr,  
Mo, W, Mn, V, Fe, Co, Ni, Cu, Ru, Rh, Ir, Ag, Au, and/or Pd and  
their supports may contain Al2O3, TiO2, ZrO2, SiO2, and/or C.  
Oxidn. of H on Pt anodes are prevented by using **H fuel**  
**gas** of decreased O concn.
- IT 7439-98-7, Molybdenum, uses 7440-33-7, Tungsten,  
uses  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and

**catalytic O removal)**

RN 7439-98-7 HCA  
CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

RN 7440-33-7 HCA  
CN Tungsten (8CI, 9CI) (CA INDEX NAME)

W

IT 630-08-0, Carbon monoxide,  
**processes**  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O removal)**  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{-C}\equiv\text{O}^+$

IT 1333-74-0P, Hydrogen, preparation  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O removal)**  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, **processes**  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O removal)**  
RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$\text{O}=\text{O}$

IC ICM H01M008-06  
ICS B01J023-42; B01J023-58; C01B003-38  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST **oxygen removal hydrogen gas**  
**fuel cell; catalytic oxygen removal**  
**hydrogen fuel gas; carbon oxide oxidative removal**  
**hydrogen fuel**  
IT **Fuel cells**

## Oxidation

(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O** removal)

- IT Alkali metals, uses  
Alkaline earth metals  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O** removal)
- IT Fuel **gas** manufacturing  
(purifn., **hydrogen**; manuf. of **hydrogen-contg.**  
**gas** for **fuel cells** by oxidative CO  
removal and **catalytic O** removal)
- IT 1314-23-4, Zirconium oxide (ZrO<sub>2</sub>), uses 1344-28-1, Cataloid AP,  
uses 7440-44-0, Carbon, uses 7631-86-9, Silicon oxide (SiO<sub>2</sub>),  
uses 13463-67-7, Tipaque CR-EL, uses  
(**catalyst** support; manuf. of **hydrogen-contg.**  
**gas** for **fuel cells** by oxidative CO  
removal and **catalytic O** removal)
- IT 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7439-96-5,  
Manganese, uses 7439-98-7, Molybdenum, uses 7440-02-0,  
Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum,  
uses 7440-09-7, Potassium, uses 7440-16-6, Rhodium, uses  
7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses  
7440-33-7, Tungsten, uses 7440-47-3, Chromium, uses  
7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 7440-57-5, Gold,  
uses 7440-62-2, Vanadium, uses  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O** removal)
- IT 630-08-0, Carbon monoxide,  
**processes**  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O** removal)
- IT 1333-74-0P, Hydrogen, preparation  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O** removal)
- IT 7782-44-7, Oxygen, **processes**  
(manuf. of **hydrogen-contg. gas** for  
**fuel cells** by oxidative CO removal and  
**catalytic O** removal)

L51 ANSWER (19) OF 30 HCA COPYRIGHT 2003 ACS on STN  
134:225083 Hybrid **fuel-cell** electric-combustion  
power system using complete pyrolysis. Manikowski, Ambrose F.;  
Noland, Gary M. (Procyon Power Systems, Inc., USA). PCT Int. Appl.  
WO 2001020703 A1 20010322, 36 pp. DESIGNATED STATES: W: AE, AG,  
AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,  
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN,  
IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG,

MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US25267 20000913. PRIORITY: US 1999-396827 19990914.

AB This is a procedure for producing mech. power and a hybrid power generation unit for practising such a process. In particular, the procedure uses a thermal or **catalytic** cracker to crack or to pyrolyze (partially or completely) a liq. or gaseous petroleum fuel to produce a primary gaseous **stream** primarily contg. **hydrogen** (and likely methane or other short-chain hydrocarbons). The hydrogen may be used in a **fuel cell** to produce electricity, which electricity is used in a linear or rotary elec. motor. In the preferred procedure, the residuum of the pyrolyzed feedstock is laid down in the reactor. A regeneration step is used to remove that residuum and produce a **carbon monoxide**-rich gas which then may be introduced to an internal or external combustion engine for further prodn. of mech. power. Most preferred of the combustion engines is one having high thermal efficiency. This combination of pyrolysis, **fuel cell**, and high efficiency heat engine results in a procedure and device which is significantly more efficient in terms of utilizing the energy present in the feedstock hydrocarbon fuel. Addnl., under high temp. operation when the fuel to the engine is a **carbon monoxide**-rich gas, the emissions from the system will be substantially lower than for conventional power systems. Finally, when some portion of the process heat required by the pyrolysis and de-coking operations is obtained from waste heat from the engine, an increase in the total thermal content of the fuel can be realized, further increasing the overall fuel economy of the hybrid system.

IT 7439-98-7, Molybdenum, uses 7440-27-9, Terbium, uses 7440-33-7, Tungsten, uses (hybrid **fuel-cell** elec.-combustion power system using complete pyrolysis)

RN 7439-98-7 HCA  
CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

RN 7440-27-9 HCA  
CN Terbium (8CI, 9CI) (CA INDEX NAME)

Tb

RN 7440-33-7 HCA  
CN Tungsten (8CI, 9CI) (CA INDEX NAME)

W

IT 630-08-0P, Carbon monoxide, uses  
 1333-74-0P, Hydrogen, uses  
 (hybrid **fuel-cell** elec.-combustion power  
 system using complete pyrolysis)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, uses  
 (hybrid **fuel-cell** elec.-combustion power  
 system using complete pyrolysis)  
 RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC ICM H01M008-06  
 ICS B60K006-04  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 48, 51, 59  
 ST **fuel cell** elec combustion power system hybrid  
 IT Engines  
 (Atkinson cycle; hybrid **fuel-cell**  
 elec.-combustion power system using complete pyrolysis)  
 IT Internal combustion engines  
 (Otto; hybrid **fuel-cell** elec.-combustion  
 power system using complete pyrolysis)  
 IT Power  
 (generation; hybrid **fuel-cell**  
 elec.-combustion power system using complete pyrolysis)  
 IT Engines  
 (heat; hybrid **fuel-cell** elec.-combustion  
 power system using complete pyrolysis)  
 IT Combustion engines  
 Cracking **catalysts**  
 Diesel engines  
**Fuel cells**  
 Fuel gas manufacturing  
 Internal combustion engines

Thermal decomposition

Thermal decomposition **catalysts**

Turbines

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT Rare earth metals, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT Hydrocarbons, uses

Petroleum, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT Power

(plants; hybrid **fuel-cell** elec.-combustion  
power system using complete pyrolysis)

IT Waste heat

(use; hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT 1308-38-9, Chromic oxide, uses 7429-91-6, Dysprosium, uses

7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7439-94-3,

Lutetium, uses 7439-96-5, Manganese, uses **7439-98-7**,

Molybdenum, uses 7440-00-8, Neodymium, uses 7440-02-0, Nickel,

uses 7440-03-1, Niobium, uses 7440-04-2, Osmium, uses

7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-10-0,

Praseodymium, uses 7440-12-2, Promethium, uses 7440-15-5,

Rhenium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium,

uses 7440-19-9, Samarium, uses 7440-25-7, Tantalum, uses

7440-26-8, Technetium, uses **7440-27-9**, Terbium, uses

7440-30-4, Thulium, uses 7440-32-6, Titanium, uses

**7440-33-7**, Tungsten, uses 7440-45-1, Cerium, uses

7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses 7440-52-0,

Erbium, uses 7440-53-1, Europium, uses 7440-54-2, Gadolinium,

uses 7440-58-6, Hafnium, uses 7440-60-0, Holmium, uses

7440-62-2, Vanadium, uses 7440-64-4, Ytterbium, uses 7440-67-7,

Zirconium, uses 7440-74-6, Indium, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT 1344-28-1, Alumina, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT 124-38-9, Carbon dioxide, formation (nonpreparative)

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT 74-82-8, Methane, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT **630-08-0P, Carbon monoxide**, uses

**1333-74-0P, Hydrogen**, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

IT 67-56-1, Methanol, uses 7732-18-5, Water, uses **7782-44-7**

, Oxygen, uses

(hybrid **fuel-cell** elec.-combustion power  
system using complete pyrolysis)

*No - Pt/Mo*

L51 ANSWER 20 OF 30 HCA COPYRIGHT 2003 ACS on STN

134:44440 High energy ball-milled Pt-Mo **catalysts** for polymer electrolyte **fuel cells** and their tolerance to CO. Gouerec, P.; Denis, M. C.; Guay, D.; Dodelet, J. P.; Schulz, R. (INRS-Energie et Materiaux, Varennes, QC, J3X 1S2, Can.). Journal of the Electrochemical Society, 147(11), 3989-3996 (English) 2000. CODEN: JESQAN. ISSN: 0013-4651. Publisher: Electrochemical Society.

AB **Catalysts** contg. Pt and Mo were synthesized by high energy ballmilling. The two metal powders were milled together in one step with a leachable dispersing agent (Al or MgH<sub>2</sub>) and a leachable process-control agent (NaF or MgH<sub>2</sub>) to increase the specific area of the **catalysts** and avoid sticking of the **catalyst**'s precursor on the vial walls and grinding balls. The **catalysts** were labeled Pt<sub>0.5</sub>Mo<sub>0.5</sub>(Al)<sub>4</sub> and Pt<sub>0.5</sub>Mo<sub>0.5</sub>(MgH<sub>2</sub>)<sub>4</sub> to reflect the bulk at. or mol. nominal content of the milled powders. After the leaching step, the actual bulk Mo content of both **catalysts** was rather low (.apprx.5 at.%). Despite their low Mo content, both **catalysts** displayed a similar performance, in H<sub>2</sub> + 100 ppm CO/O<sub>2</sub> **fuel cell** tests, to that displayed by Pt<sub>0.5</sub>Ru<sub>0.5</sub> black from Johnson Matthey. The best **catalyst** in H<sub>2</sub> + 100 ppm CO was Pt<sub>0.5</sub>Mo<sub>0.5</sub>(MgH<sub>2</sub>)<sub>4</sub>, which is a face-centered cubic solid soln. of Mo (.apprx.5 at.%) in Pt with a specific area of 35.9 m<sup>2</sup>/g. By combining X-ray diffraction, XPS, and **fuel cell** test results, it was possible to det. that Pt was metallic in the **catalyst**, but that Mo(V and VI) were present at the surface of the working anode in H<sub>2</sub> + 100 ppm CO.

IT 7439-98-7, Molybdenum, uses  
(high energy ball-milled Pt-Mo **catalysts** for polymer electrolyte **fuel cells** and their tolerance to CO)

RN 7439-98-7 HCA  
CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67, 72

ST ball milled platinum molybdenum alloy **catalyst**; polymer electrolyte **fuel cell catalyst**; carbon monoxide tolerance **catalyst** **fuel cell**

IT Ball milling  
**Catalysts**  
**Fuel cell anodes**  
**Fuel cells**  
Mechanical alloying

(high energy ball-milled Pt-Mo **catalysts** for polymer electrolyte **fuel cells** and their tolerance to CO)

IT 7439-98-7, Molybdenum, uses 7440-06-4, Platinum, uses (high energy ball-milled Pt-Mo **catalysts** for polymer electrolyte **fuel cells** and their tolerance to CO)

L51 ANSWER 21 OF 30 HCA COPYRIGHT 2003 ACS on STN

134:19381 Water-gas shift reactor warm-up in **PEM fuel cell** system. Yu, Taichiang P.; Schoeneweiss, Michael R. (General Motors Corp., USA). Eur. Pat. Appl. EP 1058328 A2 20001206, 8 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2000-109369 20000502. PRIORITY: US 1999-323465 19990601.

AB Shortening the warm-up time of a water-gas-shift reactor is attained by **injecting oxygen** throughout its **catalyst** bed as the reactor is heating up. The oxygen reacts exothermically with CO in the input gas to the reactor to generate heat that supplements the external heat put into the reactor.

IT 7440-50-8, Copper, uses (water-gas shift reactor warm-up in **PEM fuel cell** system)

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0P, Hydrogen, uses (water-gas shift reactor warm-up in **PEM fuel cell** system)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions (water-gas shift reactor warm-up in **PEM fuel cell** system)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IT 7782-44-7, Oxygen, uses (water-gas shift reactor warm-up in **PEM fuel cell** system)



RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC ICM H01M008-06  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST **fuel cell** system water gas shift reactor warmup  
 IT **Fuel cells**  
 Water gas shift reaction  
 Water gas shift reaction **catalysts**  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT Gasoline  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT Hydrocarbons, uses  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT 1314-13-2, Zinc oxide zno, uses 1332-37-2, Iron oxide, uses  
 7440-50-8, Copper, uses 11118-57-3, Chromium oxide  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT 1333-74-0P, Hydrogen, uses  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT 67-56-1, Methanol, reactions  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT 630-08-0, Carbon monoxide, reactions  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)  
 IT 7782-44-7, Oxygen, uses  
 (water-gas shift reactor warm-up in **PEM fuel cell** system)

*No-Pt + other shift*

L51 ANSWER (22) OF 30 HCA COPYRIGHT 2003 ACS on STN  
 133:225487 Pt-based nanocomposites produced by high energy ball milling  
 as electrocatalysts in polymer electrolyte **fuel cells**. Lalande, G.; Denis, M. C.; Guerec, P.; Guay, D.;  
 Dodelet, J. P.; Schulz, R. (IREQ, Hydro-Quebec, Varennes, QC,  
 J3X-1S1, Can.). Journal of New Materials for Electrochemical  
 Systems, 3(3), 185-192 (English) 2000. CODEN: JMESFQ. ISSN:  
 1480-2422. Publisher: Journal of New Materials for Electrochemical  
 Systems.

AB Ball milling of Pt powder with powders of WO<sub>2</sub>, WO<sub>3</sub>, MoO<sub>2</sub> or MoO<sub>3</sub> has  
 been performed to synthesize CO-tolerant nanocomposite anode  
 electrocatalysts for **polymer electrolyte membrane fuel cells**. In order to  
 increase the sp. surface area of the final products and to prevent  
 sticking during milling, MgH<sub>2</sub> was added to the powders as a

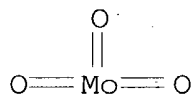
dispersing agent. After milling,  $MgH_2$  was leached away in 1M HCl (lixiviation step). The sp. surface areas of the new **catalysts** range from 12.4 to 33.5 m<sup>2</sup>/g. X-ray diffraction indicates that  $WO_x$ -based **catalysts** are true nanocomposites while  $MoO_x$ -based systems display only the Pt structure. **Catalysts** obtained by milling Pt+ $WO_3$  are made of Pt nanocrystals and crystallites of  $WO_3 \cdot bul. H_2O$ ,  $H_0.12WO_3 \cdot bul. 2H_2O$  and  $H_2WO_4 \cdot bul. H_2O$ , while **catalysts** obtained by milling Pt+ $WO_2$  are made of Pt nanocrystals and crystallites of  $WO_3$  and  $WO_3 \cdot bul. H_2O$ . For the Pt+ $MoO_x$  systems, the ball milled Mo oxides decomp. into Mo-based species and are leached away during the lixiviation step. XPS of Pt+ $MoO_x$  indicates that some Mo remains in these **catalysts** and that it is in solid soln. into the Pt structure. In **fuel cell** tests with  $H_2$  + 100 ppm CO at the anode and  $O_2$  at the cathode, Pt+ $WO_x$  **catalysts** and com. PtRu black display comparable CO-tolerance while Pt+ $MoO_x$  powders exhibit lower performances. Pt+ $WO_3$  **catalysts** lack, however, long term stability, their c.d. at 0.5 V decreasing at about 3%/100 h.

IT 1313-27-5, Molybdena, uses 1314-35-8, Tungsten trioxide, uses 12036-22-5, Tungsten dioxide 18868-43-4, Molybdenum dioxide

(platinum-based nanocomposites produced by high energy ball milling as electrocatalysts in polymer electrolyte **fuel cells**)

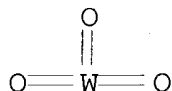
RN 1313-27-5 HCA

CN Molybdenum oxide ( $MoO_3$ ) (7CI, 8CI, 9CI) (CA INDEX NAME)



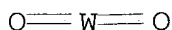
RN 1314-35-8 HCA

CN Tungsten oxide ( $WO_3$ ) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



RN 12036-22-5 HCA

CN Tungsten oxide ( $WO_2$ ) (6CI, 8CI, 9CI) (CA INDEX NAME)



RN 18868-43-4 HCA

CN Molybdenum oxide ( $MoO_2$ ) (8CI, 9CI) (CA INDEX NAME)



IT 630-08-0, **Carbon monoxide**, miscellaneous  
 (platinum-based nanocomposites produced by high energy ball  
 milling as electrocatalysts in polymer electrolyte **fuel  
 cells**)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 67, 72  
 ST ball milling platinum powder anode **catalyst**; anode  
 electrocatalyst **carbon monoxide** tolerant;  
 polymer electrolyte **fuel cell** anode  
**catalyst**  
 IT **Oxidation catalysts**  
 (electrochem.; platinum-based nanocomposites produced by high  
 energy ball milling as electrocatalysts in polymer electrolyte  
**fuel cells**)  
 IT Ball milling  
**Fuel cell** anodes  
 (platinum-based nanocomposites produced by high energy ball  
 milling as electrocatalysts in polymer electrolyte **fuel  
 cells**)  
 IT 1313-27-5, Molybdena, uses 1314-35-8, Tungsten  
 trioxide, uses 7440-06-4, Platinum, uses 12036-22-5,  
 Tungsten dioxide 18868-43-4, Molybdenum dioxide  
 (platinum-based nanocomposites produced by high energy ball  
 milling as electrocatalysts in polymer electrolyte **fuel  
 cells**)  
 IT 630-08-0, **Carbon monoxide**, miscellaneous  
 (platinum-based nanocomposites produced by high energy ball  
 milling as electrocatalysts in polymer electrolyte **fuel  
 cells**)

L51 ANSWER (23) OF 30 HCA COPYRIGHT 2003 ACS on STN  
 132:154457 Method for the production of Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** No - Au/Fe<sub>2</sub>O<sub>3</sub>  
 materials and their use in **polymer electrolyte  
 membrane fuel cells**. Plzak, Vojtech  
 (Zentrum fur Sonnenenergie- und Wasserstoff-Forschung  
 Baden-Wurttemberg, Germany). PCT Int. Appl. WO 2000009259 A2  
 20000224, 14 pp. DESIGNATED STATES: W: CA, US; RW: AT, BE, CH, CY,  
 DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (German).  
 CODEN: PIXXD2. APPLICATION: WO 1999-DE2528 19990811. PRIORITY: DE  
 1998-19836585 19980812.  
 AB The invention relates to an Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** material  
 comprised of a particle-shaped, co-**catalytically** active  
 Fe<sub>2</sub>O<sub>3</sub> supporting material with metallic Au clusters deposited  
 thereupon which have a diam. of less than 4.5 nm. The  
**catalyst** materials can be obtained by: (a) reacting a

water-sol. Fe(III) salt in an aq. medium with a base; (b) impregnating the hydroxide gel which is formed thereby and which is still moist with a soln. of a water-sol. Au compd. in order to deposit complexed Au clusters on the surface of the hydroxide gel; (c) removing water from the suspension of the reaction product formed thereby; and (d) subjecting the dried reaction product to a calcination at temps. ranging from 350 to 700.degree.. The inventive **catalyst** material is esp. suited for selective low-temp. CO oxidn. in **reformate** hydrogen which is used as combustible gas for **polymer electrolyte membrane fuel cells**.

IT 1309-37-1, Ferric oxide, uses  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** materials and their use in **polymer electrolyte membrane fuel cells**)

RN 1309-37-1 HCA

CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

IT 1333-74-0P, Hydrogen, uses  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** materials and their use in **polymer electrolyte membrane fuel cells**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** materials and their use in **polymer electrolyte membrane fuel cells**)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM B01J023-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 59, 67

ST **fuel cell** gold iron oxide **catalyst**

IT **Air** purification  
(**catalytic oxidn.**; method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** materials and their use in **polymer electrolyte membrane fuel cells**)

IT **Fuel cells**

**Oxidation catalysts**

(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> **catalyst** materials and their use in **polymer electrolyte membrane fuel cells**)

- IT Carbonates, reactions  
Hydroxides (inorganic)  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> catalyst materials and  
their use in **polymer electrolyte  
membrane fuel cells**)
- IT Hydrocarbons, reactions  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> catalyst materials and  
their use in **polymer electrolyte  
membrane fuel cells**)
- IT 1309-37-1, Ferric oxide, uses 7440-57-5, Gold, uses  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> catalyst materials and  
their use in **polymer electrolyte  
membrane fuel cells**)
- IT 1333-74-0P, Hydrogen, uses  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> catalyst materials and  
their use in **polymer electrolyte  
membrane fuel cells**)
- IT 630-08-0, Carbon monoxide, reactions  
10377-60-3, Magnesium nitrate 10421-48-4, Ferric nitrate  
16903-35-8, Tetrachloroauric acid  
(method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub> catalyst materials and  
their use in **polymer electrolyte  
membrane fuel cells**)
- IT 1308-38-9, Chromia, uses 1309-48-4, Magnesia, uses 1344-28-1,  
Alumina, uses  
(sintering inhibitor; method for prodn. of Au/Fe<sub>2</sub>O<sub>3</sub>  
**catalyst materials and their use in polymer  
electrolyte membrane fuel  
cells**)
- L51 ANSWER (24) OF 30 HCA COPYRIGHT 2003 ACS on STN nb  
132:99526 Method of screening compositions for electrocatalytic  
activity. Mallouk, Thomas E.; Smotkin, Eugene; Reddington, Erik;  
Sapienza, Anthony (The Penn State Research Foundation, USA). PCT  
Int. Appl. WO 2000004362 A2 20000127, 34 pp. DESIGNATED STATES: W:  
CA, DE, JP. (English). CODEN: PIXXD2. APPLICATION: WO  
1999-US12520 19990604. PRIORITY: US 1998-88294 19980605.
- AB Methods for identifying compns. useful for **catalyzing**  
electrochem. reactions are described. The methods involve  
simultaneously screening a large no. of compns. for electrocatalytic  
activity using a single voltage source.
- IT 7782-44-7, Oxygen, properties  
(screening compns. for electrocatalytic activity by measuring of  
potential-current relationship in gas diffusion electrolytic cell  
with methanol-water soln.).
- RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

- IT 7439-98-7, Molybdenum, uses

(screening compns. for electrocatalytic activity contg.)

RN 7439-98-7 HCA  
CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

IT 630-08-0, **Carbon monoxide**, properties  
1333-74-0, Hydrogen, properties  
(use in gas diffusion cell for screening compns. for  
electrocatalytic activity)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IC ICM G01N  
CC 72-2 (Electrochemistry)  
Section cross-reference(s): 67

IT **Catalysts**  
(electrocatalysts; screening compns. for electrocatalytic  
activity for reactions in batteries and **fuel**  
**cells**)

IT Oxidation, electrochemical  
(of hydrogen and **carbon monoxide**, in screening  
compns. for electrocatalytic activity)

IT Electric screening  
(screening compns. for electrocatalytic activity for reactions in  
batteries and **fuel cells**)

IT 7782-44-7, Oxygen, properties  
(screening compns. for electrocatalytic activity by measuring of  
potential-current relationship in gas diffusion electrolytic cell  
with methanol-water soln.)

IT 7439-88-5, Iridium, uses 7439-98-7, Molybdenum, uses  
7440-04-2, Osmium, uses 7440-06-4, Platinum, uses 7440-16-6,  
Rhodium, uses 7440-18-8, Ruthenium, uses  
(screening compns. for electrocatalytic activity contg.)

IT 630-08-0, **Carbon monoxide**, properties  
1333-74-0, Hydrogen, properties  
(use in gas diffusion cell for screening compns. for  
electrocatalytic activity)

L51 ANSWER (27) OF 30 HCA COPYRIGHT 2003 ACS on STN  
132:37936 Autothermal combustion systems for fuels conversion and  
reforming. Cole, Jerald A. (Energy and Environmental Research

Corporation, USA). U.S. US 6007699 A 19991228, 18 pp. (English).  
 CODEN: USXXAM. APPLICATION: US 1996-700838 19960821.

AB Fuel is oxidized and the heat is transferred for further use in an autothermal combustion and reforming system. A bed is forming of an unmixed combustion **catalyst**, which in an oxidized state is readily reducible and in a reduced state is readily oxidizable, and placed in efficient thermal contact with a heat receiver for use in the combustion system. Fuel and **air** are alternately contacted with the bed, so that fuel is oxidized, the **air** is depleted of oxygen, and heat is liberated. The heat is efficiently transferred to the heat receiver by careful selection of the materials of the bed such that the temps. produced when the fuel is oxidized and when the **air** is depleted of oxygen are advantageous to the particular use in the combustion system. The system can be used with steam reforming app., e.g., for low-sulfur **H2** generation for **fuel cells**, or with turbine based power generators.

IT **7440-31-5, Tin**, uses  
 (autothermal combustion system for steam reforming and power generation)

RN 7440-31-5 HCA

CN Tin (8CI, 9CI) (CA INDEX NAME)

Sn

IT **1333-74-0P, Hydrogen**, preparation  
 (autothermal combustion system for steam reforming and power generation)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT **630-08-0, Carbon monoxide**, uses  
 (autothermal combustion system for steam reforming and power generation)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

IC ICM C01B003-02  
 ICS C01B003-04; C01B003-26; C10G035-06

NCL 208134000

CC 51-12 (Fossil Fuels, Derivatives, and Related Products)  
 Section cross-reference(s): 47, 52, 57

ST combustion system **catalytic** autothermal; steam reforming autothermal combustion system; hydrogen prodn autothermal combustion system; power generation autothermal combustion system

- IT **Catalyst** supports  
 Combustion  
 Combustion **catalysts**  
 Diesel fuel  
 Jet aircraft fuel  
 Steam reforming  
 Steam reforming **catalysts**  
 (autothermal combustion system for steam reforming and power generation)
- IT Zeolites (synthetic), uses  
 (**catalyst** supports; autothermal combustion system for steam reforming and power generation)
- IT Reactors  
 (**catalytic**; autothermal combustion system for steam reforming and power generation)
- IT Ceramics  
 (porous, **catalyst** supports; autothermal combustion system for steam reforming and power generation)
- IT 1307-96-6, Cobalt (II) oxide, uses 1308-04-9, Cobalt (III) oxide, 1308-38-9, Chromium oxide (Cr<sub>2</sub>O<sub>3</sub>), uses 1309-37-1, Ferric oxide, uses 1313-13-9, Manganese (IV) oxide, uses 1313-99-1, Nickel oxide (NiO), uses 1317-34-6, Manganese (III) oxide 1344-43-0, Manganese (II) oxide, uses 1345-25-1, Ferrous oxide, uses 7440-02-0, Nickel, uses **7440-31-5**, Tin, uses 12017-00-4, Cobalt oxide (Co<sub>2</sub>O<sub>3</sub>) 12018-01-8, Chromium (IV) oxide 18282-10-5, Tin oxide (SnO<sub>2</sub>) 37367-98-9, Molybdic acid, Calcium salt  
 (autothermal combustion system for steam reforming and power generation)
- IT **1333-74-0P**, Hydrogen, preparation 7727-37-9P, Nitrogen, preparation  
 (autothermal combustion system for steam reforming and power generation)
- IT 67-56-1, Methanol, uses 74-82-8, Methane, uses **630-08-0**, **Carbon monoxide**, uses 7664-41-7, Ammonia, uses  
 (autothermal combustion system for steam reforming and power generation)
- IT 409-21-2, Silicon carbide (SiC), uses 471-34-1, Calcium carbonate, uses 1302-88-1, Cordierite 1305-78-8, Calcium oxide, uses 1309-48-4, Magnesia, uses 1344-28-1, Alumina, uses 7631-86-9, Silica, uses  
 (**catalyst** supports; autothermal combustion system for steam reforming and power generation)
- L51 ANSWER **(26)** OF 30 HCA COPYRIGHT 2003 ACS on STN  
 123:318015 Procedure and apparatus for **carbon monoxide** removal from methanol/steam **reforming** process gas. Steinwandel, Juergen; Jehle, Walter; Staneff, Theodor (Daimler-Benz A.-G., Germany). Ger. Offen. DE 4408962 A1 19950921, 5 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1994-4408962 19940316.
- AB CO is removed from the MeOH/steam **reforming** process gas by conversion to C and CO<sub>2</sub> according to the Boudouard equil. C is sepd. by deposition on a Fe-group (i.e., Fe, Co, Ni) or Pd

viewed Pt catalyst



**catalyst** on a kieselguhr support at .ltoreq.350.degree..  
 The C-loaded **catalyst** is regenerated by C oxidn. in an  
 O-contg. **gas stream**. Optionally, the (  
 CO + CO2)-contg. **gas** mixt. exiting the regenerated  
 reactor is fed into another reactor contg. a Pt catalyst  
 where the final CO oxidn. is performed. The **reforming** is  
 done in 1 **reforming** reactor with attached .gtoreq.2  
 alternating carbonization reactors (i.e., with 1 reactor in the  
 process mode and 1 reactor in the regeneration mode). The resulting  
 H2/CO2 mixt. contg. <50 ppm CO is suitable for **fuel**  
**cells** in motor vehicles.

IT 1333-74-0P, Hydrogen, preparation  
 (carbon monoxide removal from methanol/steam  
 reforming process gas in manuf. of)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses  
 (for carbon monoxide removal from  
 methanol/steam reforming process gas)  
 RN 7439-89-6 HCA  
 CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

RN 7440-48-4 HCA  
 CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 630-08-0, Carbon monoxide, processes  
 (removal from methanol/steam reforming process gas)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM C01B003-50  
 ICS H01M008-06; H01M008-22  
 ICA B01J023-80; B01J021-04; B01J023-74; B01J023-44; B01J021-08;  
 B01J023-94; B01J023-96  
 CC 49-1 (Industrial Inorganic Chemicals)  
 Section cross-reference(s): 52  
 ST carbon monoxide removal steam reforming  
 IT Reactors  
 (for carbon monoxide removal from

- methanol/steam **reforming** process gas)
- IT **Fuel cells**  
(hydrogen manuf. by methanol/steam **reforming** for)
- IT **Reforming**  
(steam, **carbon monoxide** removal from  
methanol/steam **reforming** process gas)
- IT 67-56-1, Methanol, processes  
(**carbon monoxide** removal from methanol/steam  
**reforming** process gas)
- IT 1333-74-0P, Hydrogen, preparation  
(**carbon monoxide** removal from methanol/steam  
**reforming** process gas in manuf. of)
- IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-05-3,  
Palladium, uses 7440-06-4, Platinum, uses 7440-48-4,  
Cobalt, uses  
(for **carbon monoxide** removal from  
methanol/steam **reforming** process gas)
- IT 630-08-0, **Carbon monoxide**, processes  
(removal from methanol/steam **reforming** process gas)
- L51 ANSWER 27 OF 30 HCA COPYRIGHT 2003 ACS on STN ~o  
121:61419 A fuel conditioning system for a methanol-fuelled  
**PEM fuel cell** power generator. Mann,  
Ronald F.; Amphlett, John C.; Peppley, Brant A. (R. Mil. Coll.  
Canada, Kingston, ON, K7K 5L0, Can.). *Frontiers Science Series*,  
7(New Energy Systems and Conversions), 613-18 (English) 1993.  
CODEN: FCFUEO. ISSN: 0915-8502.
- AB A fuel conditioning system to supply H-rich gas  
to a MeOH-fueled **PEM** (proton-exchange membrane)  
**fuel cell** power generator is discussed. Kinetic  
equations for the **catalytic** steam **reforming** of  
MeOH on CuO/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst** and the preferential oxidn.  
of CO on Pt/Al<sub>2</sub>O<sub>3</sub> **catalyst** were presented with a brief  
discussion of the reactor design procedure. A review of current  
MeOH steam **reformer** technol. was given with comments on  
the advantages of each design. Alternative schemes for the CO  
management system were discussed with ref. to various aspects of the  
design of this sub-system. The importance of effective system  
integration and the key issues in system optimization for  
terrestrial vehicle applications and **air**-independent  
submersible applications were discussed.
- IT 1317-38-0, Cupric oxide, uses  
(**catalyst**, contg. zinc oxide, alumina-supported, for  
steam **reforming** of methanol, for proton-exchange  
membrane **fuel cells**)
- RN 1317-38-0 HCA  
CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)
- Cu=O
- IT 630-08-0, **Carbon monoxide**, reactions

(oxidn. of, over platinum-alumina **catalyst** in  
**fuel cells**, kinetics of)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C $\equiv$ O+

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** proton exchange membrane;  
**catalytic steam reforming methanol fuel**  
**cell**

IT Kinetics of oxidation  
(of **carbon monoxide**, over platinum/alumina  
**catalyst** in **fuel cells**)

IT **Fuel cells**  
(proton-exchange membrane, **catalytic steam**  
**reforming** of methanol for and **carbon**  
**monoxide** oxidn. in, kinetics of)

IT Kinetics of **reforming**  
(steam, of methanol, for proton-exchange membrane **fuel**  
**cells**)

IT Fuel gas manufacturing  
(steam **reforming**, of methanol, for proton-exchange  
membrane **fuel cells**, kinetics of)

IT 1344-28-1, Alumina, uses  
(**catalyst**, contg. cupric oxide and zinc oxide, for  
steam **reforming** of methanol, for proton-exchange  
membrane **fuel cells**)

IT 1314-13-2, Zinc oxide, uses  
(**catalyst**, contg. cupric oxide, alumina-supported, for  
steam **reforming** of methanol, for proton-exchange  
membrane **fuel cells**)

IT 1317-38-0, Cupric oxide, uses  
(**catalyst**, contg. zinc oxide, alumina-supported, for  
steam **reforming** of methanol, for proton-exchange  
membrane **fuel cells**)

IT 7440-06-4, Platinum, uses  
(**catalyst**, for oxidn. of **carbon**  
**monoxide**, in **fuel cells**, kinetics of)

IT 67-56-1, Methanol, reactions  
(**catalytic steam reforming** of, for  
proton-exchange membrane **fuel cells**)

IT 630-08-0, **Carbon monoxide**, reactions  
(oxidn. of, over platinum-alumina **catalyst** in  
**fuel cells**, kinetics of)

ND ~~PR~~ PR

L51 ANSWER (28) OF 30 HCA COPYRIGHT 2003 ACS on STN

121:13875 Utilization of methanol for polymer electrolyte **fuel**  
**cells** in mobile systems. Schmidt, V. M.; Broeckerhoff, P.;  
Hoehlein, B.; Menzer, R.; Stimming, U. (Inst. Energy Process Eng.,  
Res. Cent. Juelich, Juelich, 52425, Germany). Journal of Power

Sources, 49(1-3), 299-313 (English) 1994. CODEN: JPSODZ. ISSN: 0378-7753.

- AB As part of the **fuel cell** program of the Juelich Research Center a vehicle propulsion system with methanol as secondary energy carrier and a **polymer electrolyte membrane fuel cell** (PEMFC) as the main component for energy conversion was developed. The fuel gas is produced by a heterogeneously **catalyzed** steam **reforming** reaction in which methanol is converted to **H<sub>2</sub>**, CO and CO<sub>2</sub>. The required energy is provided by the **catalytic** conversion of methanol for both heating up the system and **reforming** methanol. The high CO content of the fuel gas requires further processing of the gas or the development of new electrocatalysts for the anode. Various Pt-Ru alloys show promising behavior as CO-tolerant anodes. The entire **fuel cell** system is discussed in terms of energy and emission balances. The development of important components is described and exptl. results are discussed.
- IT 1317-38-0, Copper oxide (CuO), uses  
(**catalyst** of zinc and, on alumina, for steam **reforming** of methanol, for **fuel cell**)
- RN 1317-38-0 HCA
- CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)

Cu=O

- IT 1333-74-0P, Hydrogen, preparation  
(manuf. of, by steam **reforming** of methanol, for **fuel cell** for elec. vehicle)
- RN 1333-74-0 HCA
- CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

- IT 630-08-0P, **Carbon monoxide**, preparation  
(prepn. of, in steam **reforming** of methanol for hydrogen manuf., for **fuel cell**)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38, 67, 72
- ST methanol **reforming fuel cell**  
automobile; **catalytic** conversion methanol elec car
- IT **Fuel-cell** electrolytes  
(Nafion 117, in **fuel cell** coupled to steam **reforming** of methanol)

- IT Carbon black, uses  
(electrodes contg. platinum-ruthenium **catalyst** on, in electrodes of **fuel cell** for traction)
- IT **Fuel cells**  
(hydrogen-air, polymer membrane, steam **reforming** of methanol coupled to, for elec. vehicle)
- IT **Oxidation catalysts**  
(platinum-ruthenium, **carbon monoxide** -tolerant, for electrodes of **fuel cell** coupled to methanol **reforming**)
- IT Polyoxyalkylenes, uses  
(fluorine- and sulfo-contg., ionomers, electrolyte membrane, in **fuel cell** coupled to methanol **reforming**, for elec. vehicle)
- IT Fluoropolymers  
(polyoxyalkylene-, sulfo-contg., ionomers, electrolyte membrane, in **fuel cell** coupled to methanol **reforming**, for elec. vehicle)
- IT Ionomers  
(polyoxyalkylenes, fluorine- and sulfo-contg., electrolyte membrane, in **fuel cell** coupled to methanol **reforming**, for elec. vehicle)
- IT **Reforming**  
(steam, of methanol, **fuel cell** coupled to, for elec. vehicle)
- IT 7440-66-6, Zinc, uses  
(**catalyst** of copper oxide and, on alumina, for steam **reforming** of methanol, for **fuel cell**)
- IT 1317-38-0, Copper oxide (CuO), uses  
(**catalyst** of zinc and, on alumina, for steam **reforming** of methanol, for **fuel cell**)
- IT 12613-88-6, Platinum 50, ruthenium 50  
(**catalyst**, on carbon black, **carbon monoxide**-tolerant, in electrode of **fuel cell** for elec. vehicle)
- IT 66796-30-3, Nafion 117  
(electrolyte membrane, in **fuel cell** coupled to methanol **reforming**, for elec. vehicle)
- IT 1333-74-0P, Hydrogen, preparation  
(manuf. of, by steam **reforming** of methanol, for **fuel cell** for elec. vehicle)
- IT 630-08-0P, **Carbon monoxide**, preparation  
(prepn. of, in steam **reforming** of methanol for hydrogen manuf., for **fuel cell**)
- IT 67-56-1, Methanol, reactions  
(steam **reforming** and **catalytic** conversion of, **fuel cell** coupled to, for elec. vehicle)

Mo, but Methanol ox.

L51 ANSWER (29) OF 30 HCA COPYRIGHT 2003 ACS on STN  
118:68831 Electrocatalysis on SPE membrane electrodes. Kita, Hideaki;  
Nakajima, Hiroshi; Shimazu, Katsuaki (Fac. Sci., Hokkaido Univ.,  
Sapporo, 060, Japan). Electrochem. Transition, 619-28. Editor(s):

Murphy, Oliver J.; Srinivasan, Supramaniam; Conway, Brian E.  
Plenum: New York, N. Y. (English) 1992. CODEN: 580JAE.

AB The present study shows many advantages of the SPE (solid polymer electrolyte) electrode. It has a high roughness factor of several hundreds for Pt, a const. **catalytic** activity without a decay as obsd. at a Pt electrode, a high c.d. for electrode reactions of sparingly sol. species, and many features characteristic of the resp. electrode reactions. For example, CO oxidn. at a Au-SPE electrode in alk. media proceeds without a pH change because the product leaves the electrode as CO<sub>2</sub> gas, not penetrating the membrane as CO<sub>3</sub><sup>2-</sup>. The molybdenum-modified Pt-SPE electrode reveals an excellent **catalytic** activity for MeOH oxidn., which is much higher than that of the Mo-modified Pt electrode. Thus, the SPE membrane electrode has promising features for its use in various electrode reactions, esp. in **fuel cells**.

IT 7439-98-7, Molybdenum, uses  
(**catalyst**, for oxidn. of methanol at platinum  
electrode with solid **polymer electrolyte**  
**membrane**)

RN 7439-98-7 HCA

CN Molybdenum (8CI, 9CI) (CA INDEX NAME)

Mo

IT 630-08-0, **Carbon monoxide**, reactions  
(oxidn. of, electrochem., at gold electrode with anion-exchanging  
membrane)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{-C}\equiv\text{O}^+$

IT 1333-74-0, Hydrogen, reactions  
(oxidn. of, electrochem., at platinum solid-**polymer**  
**electrolyte membrane**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, reactions  
(redn. of, electrochem., at platinum-solid **polymer**  
**electrolyte membrane**)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$\text{O}=\text{O}$

- CC 72-2 (Electrochemistry)  
Section cross-reference(s): 22, 38, 52, 67
- ST electrocatalysis solid **polymer electrolyte membrane** electrode; molybdenum **catalyst** methanol electrooxidn; **carbon monoxide** electrooxidn gold polymer electrolyte; **fuel cell** electrode solid polymer electrolyte; platinum electrode solid **polymer electrolyte membrane**; gold electrode solid **polymer electrolyte membrane**
- IT Oxidation, electrochemical  
(of **carbon monoxide** and oxygen at gold or platinum electrode with solid polymer electrolyte and of methanol at molybdenum-modified platinum-solid polymer electrolyte electrode)
- IT Reduction, electrochemical  
(of oxygen at platinum-solid **polymer electrolyte membrane**)
- IT **Catalysts and Catalysis**  
(electrochem., at solid **polymer electrolyte membrane**)
- IT **Oxidation catalysts**  
(electrochem., molybdenum, platinum-solid polymer electrolyte electrode modified with, for methanol)
- IT Electrodes  
(**fuel-cell, membrane, solid polymer electrolyte**)
- IT 7439-98-7, Molybdenum, uses  
(**catalyst**, for oxidn. of methanol at platinum electrode with solid **polymer electrolyte membrane**)
- IT 7440-06-4, Platinum, uses 7440-57-5, Gold, uses  
(electrode, with solid **polymer electrolyte membrane**, roughness and electrocatalysis in relation to)
- IT 124-38-9P, Carbon dioxide, preparation  
(formation of, in **carbon monoxide** oxidn. on gold electrode with anion-exchanging membrane)
- IT 630-08-0, **Carbon monoxide**, reactions  
(oxidn. of, electrochem., at gold electrode with anion-exchanging membrane)
- IT 1333-74-0, Hydrogen, reactions  
(oxidn. of, electrochem., at platinum solid-**polymer electrolyte membrane**)
- IT 7782-44-7, Oxygen, reactions  
(redn. of, electrochem., at platinum-solid **polymer electrolyte membrane**)

L51 ANSWER (30) OF 30 HCA COPYRIGHT 2003 ACS on STN NO CO-ox?  
58:37924 Original Reference No. 58:6446d-e **Fuel cell**  
electrode processes. Young, George G.; Rozelle, Ralph B. (Alfred Univ., Alfred, NY). United States Department of Commerce, Office of Technical Services, AD [ASTIA Document], 264,264, 12 pp.

(Unavailable) 1961. CODEN: XCTAAO. ISSN: 0099-8559.  
AB cf. CA 57, 4452c. Studies were made on low temp. and pressure cells with aq. KOH, NaOH, and K<sub>2</sub>CO<sub>3</sub> electrolytes. Emphasis was on H, but data were also obtained on CO, C<sub>2</sub>H<sub>4</sub>, and C<sub>2</sub>H<sub>2</sub>. Two different porous C electrodes contg. metal **catalysts** were used. The C with higher total porosity and higher mean pore diam. was the better anode for H. Group VIII metals appear as most efficient **catalysts** for H and C<sub>3</sub>H<sub>8</sub>. Pt appears best. KOH was better than K<sub>2</sub>CO<sub>3</sub> as electrolyte for the O cathode.

IT 7440-33-7, Tungsten  
(**catalysts**, H **fuel-cell** anodes  
contg.)  
RN 7440-33-7 HCA  
CN Tungsten (8CI, 9CI) (CA INDEX NAME)

W

IT 1333-74-0, Hydrogen  
(**fuel cells**, C anodes for, contg. metal  
**catalysts**)  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen  
(**fuel cells**, electrolytes for)  
RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

CC 15 (Electrochemistry)  
IT Electrodes  
(**fuel-cell**, reactions at metal  
**catalyst**-contg. C)  
IT **Catalysts and Catalysis**  
(hydrogen **fuel cell** electrodes contg. metal)  
IT **Carbon monoxide**, dimethyl mercaptole  
(**fuel cells** using, C anodes for, contg. metal  
**catalysts**)  
IT 7439-88-5, Iridium  
(anodes, **fuel cell**, for H)  
IT 7440-05-3, Palladium  
(carbon **fuel-cell** anodes contg.)  
IT 7439-89-6, Iron  
(**catalysts**, H **fuel cell** anodes  
contg.)  
IT 7440-18-8, Ruthenium 7440-22-4, Silver 7440-33-7,



- Tungsten  
(**catalysts**, H fuel-cell anodes contg.)
- IT 7440-06-4, Platinum  
(**catalysts**, fuel-cell (H) anodes contg.)
- IT 7440-50-8, Copper  
(**catalysts**, hydrogen fuel cell anodes contg.)
- IT 7440-16-6, Rhodium 7440-48-4, Cobalt  
(**catalysts**, hydrogen fuel-cell anodes contg.)
- IT 7440-04-2, Osmium  
(**catalysts**, in fuel cells)
- IT 74-98-6, Propane  
(**fuel cells** from, reactions at electrodes in)
- IT 74-85-1, Ethylene 74-86-2, Acetylene  
(**fuel cells** using, C anodes for, contg. metal **catalysts**)
- IT 584-08-7, Potassium carbonate, K<sub>2</sub>CO<sub>3</sub> 1310-73-2, Sodium hydroxide  
(**fuel cells** with electrolytes from)
- IT 1333-74-0, Hydrogen  
(**fuel cells**, C anodes for, contg. metal **catalysts**)
- IT 7782-44-7, Oxygen  
(**fuel cells**, electrolytes for)
- IT 1310-58-3, Potassium hydroxide  
(**fuel-cell** electrolytes contg.)
- IT 7440-57-5, Gold  
(hydrogen **fuel-cell** anodes contg. **catalysts** from)
- IT 7440-02-0, Nickel  
(in alkylation of N-phenyl-p-phenylenediamine with pentyl alc., H **fuel cell** anodes contg.)

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80

L52 ANSWER (1) OF 27 HCA COPYRIGHT 2003 ACS on STN

139:182788 The nature and binding strength of carbon adspecies formed during the equilibrium dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**. Triantafyllopoulos, Nikolaos C.; Neophytides, Stylianos G. (Foundation of Research and Technology Hellas, Institute of Chemical Engineering & High Temperature Processes, Rion Achaïas, GR-26504, Greece). Journal of Catalysis, 217(2), 324-333 (English) 2003. CODEN: JCTLA5. ISSN: 0021-9517. Publisher: Elsevier Science.

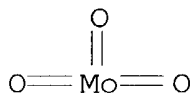
AB The equil. dissociative adsorption of CH<sub>4</sub> was studied over Ni-YSZ cermet **catalysts** for a deeper insight regarding the nature and binding strength of generated carbon species on the Ni-YSZ surface. Three main carbon species were detected by the reaction of carbon ad-species with H<sub>2</sub> to produce CH<sub>4</sub> or with

O<sub>2</sub> to produce CO and CO<sub>2</sub>. Carbide species (Cc) are reactive with H<sub>2</sub> and O<sub>2</sub> at temps. <600 .degree.K while adsorbed carbon (Ca) species in equil. with CH<sub>x</sub> species react with H<sub>2</sub> and O<sub>2</sub> >600 .degree.K. Graphitic carbon layers (Cg) are formed upon CH<sub>4</sub> adsorption >700 .degree.K and its main characteristic is the absence of any reactivity with H<sub>2</sub>, to form CH<sub>4</sub>. The binding energy of Ca species with respect to graphite decreases with increasing coverage ranging between 7.32 +- 0.03 and 6.5 +- 0.04 eV for the low (< 0.2 ML) and high (.apprx. 1 ML) coverage, resp. The presence of 1% wt. of Mo either suppresses the formation of adsorbed graphitic layers which are not reactive with H<sub>2</sub> or enhances the reactivity of adsorbed hydrogen atoms toward CH<sub>4</sub> at temps. >800 .degree.K, thus revealing the pos. effect of Mo in inhibiting the formation of adsorbed graphitic layers.

IT 1333-74-0, Hydrogen, reactions  
     (catalyst preredn.; nature and binding strength of  
     carbon ad-species formed during equil. dissociative adsorption of  
     CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 1313-27-5, Molybdenum oxide (MoO<sub>3</sub>), reactions  
 7782-44-7, Oxygen, reactions  
     (nature and binding strength of carbon ad-species formed during  
     equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
     **catalysts**)  
 RN 1313-27-5 HCA  
 CN Molybdenum oxide (MoO<sub>3</sub>) (7CI, 8CI, 9CI) (CA INDEX NAME)



RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 630-08-0, Carbon monoxide, formation  
     (nonpreparative)  
     (quant. burnoff; nature and binding strength of carbon ad-species  
     formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ  
     cermet **catalysts**)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 51, 67
- ST carbon adspecies equil dissociative adsorption methane nickel  
molybdenum YSZ; solid oxide **fuel cell** cermet  
methane electrochem **oxidn catalyst**
- IT Adsorption enthalpy  
Cermets  
Dissociative chemisorption  
Dissociative chemisorption enthalpy  
Oxidation, electrochemical  
(nature and binding strength of carbon ad-species formed during  
equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
**catalysts**)
- IT Solid state **fuel cells**  
(oxide; nature and binding strength of carbon ad-species formed  
during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
**catalysts**)
- IT 1333-74-0, Hydrogen, reactions  
(**catalyst** preredn.; nature and binding strength of  
carbon ad-species formed during equil. dissociative adsorption of  
CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 7440-44-0, Carbon, reactions  
(deposits on anode; nature and binding strength of carbon  
ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on  
Ni-YSZ cermet **catalysts**)
- IT 12012-02-1, Nickel carbide (Ni<sub>3</sub>C)  
(formed on **catalyst**; nature and binding strength of  
carbon ad-species formed during equil. dissociative adsorption of  
CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 7440-02-0P, Nickel, uses  
(nature and binding strength of carbon ad-species formed during  
equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
**catalysts**)
- IT 67-63-0, 2-Propanol, uses  
(nature and binding strength of carbon ad-species formed during  
equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
**catalysts**)
- IT 1071-76-7, Zirconium tetra-n-butoxide 1313-27-5,  
Molybdenum oxide (MoO<sub>3</sub>), reactions 7664-41-7, Ammonia, reactions  
7697-37-2, Nitric acid, reactions 7782-44-7, Oxygen,  
reactions 13478-00-7, Nickel nitrate hexahydrate 13494-98-9,  
Yttrium nitrate hexahydrate  
(nature and binding strength of carbon ad-species formed during  
equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
**catalysts**)
- IT 74-82-8, Methane, uses  
(nature and binding strength of carbon ad-species formed during  
equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet  
**catalysts**)

- IT 64417-98-7P, Yttrium zirconium oxide  
(nickel and nickel/molybdenum -loaded; nature and binding strength of carbon ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 62649-98-3P  
(phase in Ni-Mo/YSZ **catalyst**; nature and binding strength of carbon ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 1313-99-1P, Nickel oxide (NiO), uses  
(phase in pre-reduced **catalyst**; nature and binding strength of carbon ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 124-38-9, Carbon dioxide, formation (nonpreparative)  
**630-08-0, Carbon monoxide**, formation (nonpreparative)  
(quant. burnoff; nature and binding strength of carbon ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 1314-23-4P, Zirconia, uses  
(yttria-stabilized, nickel and nickel/molybdenum -loaded; nature and binding strength of carbon ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)
- IT 1314-36-9P, Yttria, uses  
(zirconia stabilized by, nickel and nickel/molybdenum -loaded; nature and binding strength of carbon ad-species formed during equil. dissociative adsorption of CH<sub>4</sub> on Ni-YSZ cermet **catalysts**)

L52 ANSWER (2) OF 27 HCA COPYRIGHT 2003 ACS on STN

139:56985 Enhancement of the OSC properties of Ce-Zr based solid solutions. Nunan, John Gerard; Bortun, Anatoly I. (Delphi Technologies, Inc., USA). U.S. US 6585944 B1 20030701, 24 pp. (English). CODEN: USXXAM. APPLICATION: US 2000-690208 20001017.

AB The present invention relates to high oxygen ion conducting/oxygen storage (OIC/OS) capacity materials, a **catalyst** employing the OIC/OS materials, and a method for converting hydrocarbons, **carbon monoxide** and nitrogen oxides using the **catalyst**. The OIC/OS materials have stable cubic cryst. structures such that after aging for greater than about 36 h at temps. up to about 1,200 .degree.C, greater than about 60-95% of the cerium present is reducible. These materials comprise up to about 95 mol percent (mol %) zirconium, up to about 50 mol % cerium, up to about 20 mol % of a stabilizer such as yttrium, rare earth elements, and the like; and about 0.01 to about 25 mol % of a base metal selected from the group consisting of iron, copper, cobalt, nickel, silver, manganese, bismuth and mixts. comprising at least one of the foregoing metals. Due to the enhanced phase stability and oxygen ion conducting properties of these OIC/OS materials, they can be employed in numerous applications, including: in solid oxide **fuel cells** (SOFC) for energy conversion, in electrochem. oxygen sensors, in oxygen ion pumps, structural

ceramics of high toughness, in heating elements, in electrochem. reactors, in steam electrolysis cells, in electrochromic materials, in MHD (MHD) generators, in hydrogen sensors, in **catalysts** for methanol decompn., as potential hosts for immobilizing nuclear waste, as oxygen storage materials in three-way-conversion (TWC) **catalysts**, as well as in other **applications** where **oxygen** storage capacity and/or oxygen ion cond. are factors.

IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses  
7440-50-8, Copper, uses  
(enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)

RN 7439-89-6 HCA

CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 630-08-0, **Carbon monoxide**, processes  
(enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

IT 7782-44-7, Oxygen, analysis  
(sensors, electrochem.; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC ICM B01D053-56

NCL 423239100; 423245100; 423247000; 502302000; 502304000; 502340000;  
502349000; 502355000

CC 59-3 (Air Pollution and Industrial Hygiene)

Section cross-reference(s): 47, 52, 58, 67, 77

- IT Decomposition **catalysts**  
(for methanol decompn.; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)
- IT **Gas sensors**  
(**hydrogen**; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)
- IT Solid state **fuel cells**  
(oxide; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)
- IT Exhaust **gas catalytic** converters  
(**oxygen storage catalysts**; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)
- IT **Gas sensors**  
(**oxygen**, electrochem.; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)
- IT **Catalysts**  
(three-way; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)
- IT **7439-89-6**, Iron, uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses 7440-22-4, Silver, uses 7440-45-1, Cerium, uses **7440-48-4**, Cobalt, uses **7440-50-8**, Copper, uses 7440-65-5, Yttrium, uses 7440-67-7, Zirconium, uses 7440-69-9, Bismuth, uses 547768-98-9 547768-99-0, Cerium iron yttrium zirconium oxide (Ce<sub>0.1</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.74</sub>O<sub>1.92</sub>) 547769-00-6, Cerium iron yttrium zirconium oxide (Ce<sub>0.15</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.69</sub>O<sub>1.92</sub>) 547769-01-7, Cerium iron yttrium zirconium oxide (Ce<sub>0.2</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.64</sub>O<sub>1.92</sub>) 547769-02-8, Cerium iron yttrium zirconium oxide (Ce<sub>0.25</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.59</sub>O<sub>1.92</sub>) 547769-03-9, Cerium iron yttrium zirconium oxide (Ce<sub>0.3</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.54</sub>O<sub>2.92</sub>) 547769-04-0, Cerium iron yttrium zirconium oxide (Ce<sub>0.35</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.49</sub>O<sub>1.92</sub>) 547769-05-1, Cerium iron yttrium zirconium oxide (Ce<sub>0.4</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.44</sub>O<sub>1.92</sub>) 547769-06-2, Cerium iron yttrium zirconium oxide (Ce<sub>0.45</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.39</sub>O<sub>1.92</sub>) 547769-07-3, Cerium iron yttrium zirconium oxide (Ce<sub>0.5</sub>Fe<sub>0.04</sub>Y<sub>0.12</sub>Zr<sub>0.34</sub>O<sub>1.92</sub>) 547769-08-4, Cerium iron yttrium zirconium oxide (Ce<sub>0.1</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.75</sub>O<sub>1.92</sub>) 547769-09-5, Cerium iron yttrium zirconium oxide (Ce<sub>0.15</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.70</sub>O<sub>1.92</sub>) 547769-10-8, Cerium iron yttrium zirconium oxide (Ce<sub>0.2</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.65</sub>O<sub>1.92</sub>) 547769-11-9, Cerium iron yttrium zirconium oxide (Ce<sub>0.25</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.60</sub>O<sub>1.92</sub>) 547769-12-0, Cerium iron yttrium zirconium oxide (Ce<sub>0.3</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.55</sub>O<sub>1.92</sub>) 547769-13-1, Cerium iron yttrium zirconium oxide (Ce<sub>0.35</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.50</sub>O<sub>1.92</sub>) 547769-14-2, Cerium iron yttrium zirconium oxide (Ce<sub>0.4</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.45</sub>O<sub>1.92</sub>) 547769-15-3, Cerium iron yttrium zirconium oxide (Ce<sub>0.45</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.40</sub>O<sub>1.92</sub>) 547769-16-4, Cerium iron yttrium zirconium oxide (Ce<sub>0.5</sub>Fe<sub>0.05</sub>Y<sub>0.1</sub>Zr<sub>0.35</sub>O<sub>1.92</sub>) 547769-17-5, Cerium iron yttrium zirconium oxide (Ce<sub>0.37</sub>Fe<sub>0.03</sub>Y<sub>0.09</sub>Zr<sub>0.50</sub>O<sub>1.96</sub>) 547769-18-6, Cerium copper yttrium zirconium oxide (Ce<sub>0.35</sub>Cu<sub>0.03</sub>Y<sub>0.12</sub>Zr<sub>0.50</sub>O<sub>1.91</sub>) 547769-19-7, Cerium nickel yttrium zirconium oxide (Ce<sub>0.35</sub>Ni<sub>0.06</sub>Y<sub>0.15</sub>Zr<sub>0.44</sub>O<sub>1.86</sub>) 547769-20-0, Cerium iron yttrium zirconium oxide (Ce<sub>0.35</sub>Fe<sub>0.06</sub>Y<sub>0.15</sub>Zr<sub>0.44</sub>O<sub>1.9</sub>) 547769-21-1, Cerium

iron yttrium zirconium oxide ( $\text{Ce}_{0.3}\text{Fe}_{0.1}\text{Y}_{0.04}\text{Zr}_{0.56}\text{O}_{1.93}$ )

547769-22-2, Cerium iron lanthanum zirconium oxide

( $\text{Ce}_{0.35}\text{Fe}_{0.1}\text{La}_{0.1}\text{Zr}_{0.45}\text{O}_{1.9}$ )

(enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)

IT 630-08-0, Carbon monoxide, processes

11104-93-1, Nitrogen oxide, processes

(enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)

IT 7782-44-7, Oxygen, analysis

(sensors, electrochem.; enhancement of the oxygen storage capacity properties of Ce-Zr based solid solns.)

L52 ANSWER (3) OF 27 HCA COPYRIGHT 2003 ACS on STN

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139:55410 A CuO-CeO<sub>2</sub> Mixed-Oxide **Catalyst** for CO Clean-Up by Selective Oxidation in Hydrogen-Rich Mixtures. Kim, Dong Hyun; Cha, Jung Eun (Department of Chemical Engineering, Kyungpook National University, Taegu, 702-701, S. Korea). Catalysis Letters, 86(1-3), 107-112 (English) 2003 CODEN: CALER. ISSN: 1011-372X. Publisher: Kluwer Academic/Plenum Publishers.

AB A CuO-CeO<sub>2</sub> mixed-oxide **catalyst** was shown exptl. to be highly active and selective for the oxidn. of CO in hydrogen-rich mixts., and an attractive alternative to the noble metal **catalysts** presently used for CO clean-up in hydrogen mixts. for proton-exchange membrane **fuel cells** (PEMFC). Although the presence of H<sub>2</sub>O and CO<sub>2</sub> in the feed decreased the activity and increased the reaction temp. considerably to achieve a given CO conversion with a reactor, the selectivity profile with respect to the conversion remained virtually the same. The effect of H<sub>2</sub>O and CO<sub>2</sub> on the reaction was found to increase the required energy for redn. of the active copper species in the redox cycles undergone during the reaction. The **catalyst** showed a slow, reversible deactivation, but the activity was restored on heating the **catalyst** at 300 .degree.C, even under an inert flow. At space velocities above 42 g h m<sup>-3</sup>, the **catalyst** reduced the CO content to less than 10 ppm in the temp. range 166-176 .degree.C for a feed of 1% CO, 1% O<sub>2</sub>, 50% H<sub>2</sub>, 20% H<sub>2</sub>O, 13.5% CO<sub>2</sub> and balance He. Hence, with this **catalyst** it is feasible to clean up the CO in a single-stage reactor with relatively small excess oxygen, which is in contrast to the typical multistage reactor systems using noble metal **catalysts**.

IT 1317-38-0, Copper oxide CuO, uses

(CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

RN 1317-38-0 HCA

CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)

Cu=O

IT 1333-74-0, Hydrogen, uses

(CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, **Carbon monoxide**, processes  
(oxidn.; CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

CC 52-5 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 49, 59, 67

ST copper oxide ceria **catalyst carbon monoxide oxidn** hydrogen mixt; **catalyst mixed oxide carbon monoxide oxidn** hydrogen rich mixt

IT **Oxidation catalysts**  
(CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

IT **Fuel cells**  
(proton-exchange membrane; CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

IT Fuel gas manufacturing  
(steam **reforming**; CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts. in relation to)

IT 1306-38-3, Ceria CeO<sub>2</sub>, uses 1317-38-0, Copper oxide CuO, uses  
(CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

IT 1333-74-0, Hydrogen, uses  
(CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

IT 630-08-0, **Carbon monoxide**, processes  
(oxidn.; CuO-CeO<sub>2</sub> mixed-oxide **catalyst** for CO clean-up by selective oxidn. in hydrogen-rich mixts.)

L52 ANSWER (4) OF 27 HCA COPYRIGHT 2003 ACS on STN  
138:257716 Influence of preparation method on performance of Cu/Zn-based **catalysts** for low-temperature steam **reforming** and oxidative steam **reforming** of methanol for H<sub>2</sub> production for **fuel cells**. Shen, Jian-Ping; Song, Chunshan (Department of Energy and Geo-Environmental Engineering, The Pennsylvania State University, University Park, PA, 16802, USA). Catalysis Today, 77(1-2), 89-98 (English) 2002. b0



- CODEN: CATTEA. ISSN: 0920-5861. Publisher: Elsevier Science B.V..
- AB Impregnation, co-pptn. and hydrothermal synthesis methods for prepn. of precursors for Cu/Zn/Al **catalysts** were compared. Steam **reforming** and oxidative steam **reforming** of MeOH was performed using lab.-prepd. and com. Cu/Zn/Al **catalysts** at 230.degree. for the **catalytic** prodn. of H<sub>2</sub>. The prepn. method influences **catalyst** performance with respect to MeOH conversion, H<sub>2</sub> yield and CO concn. The **catalyst** with lower Cu-redn. temp. shows higher activity for MeOH conversion at a lower temp. The best Cu/Zn/Al **catalyst** was prepd. by the co-pptn. method. At a temp. of 230.degree. the **catalyst** had a high activity for MeOH conversion (99-100%) and H<sub>2</sub> prodn. (71-76%) with very low CO concn. (0.05-0.15%) in steam **reforming** (H<sub>2</sub>O/MeOH mol ratio 1.43) and in oxidative steam **reforming** (O<sub>2</sub>/MeOH mol ratio 0.158-0.474).
- IT 1317-38-0, Cupric oxide, uses  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- RN 1317-38-0 HCA
- CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)

Cu=O

- IT 1333-74-0P, Hydrogen, uses  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- RN 1333-74-0 HCA
- CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

- IT 630-08-0, Carbon monoxide, formation  
(nonpreparative)  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

- CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67

- ST aluminum copper zinc **catalyst** prepn methanol steam **reforming**; hydrogen prodn methanol oxidative steam **reforming** copper zinc **catalyst**; **fuel cell** hydrogen prodn methanol steam **reforming catalyst**
- IT Zeolite MCM-41  
(**catalyst** support; influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT Steam **reforming**  
Steam **reforming catalysts**  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT 1314-13-2, Zinc oxide, uses 1344-28-1, Alumina, uses  
(**catalyst** contg.; influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT 1317-38-0, Cupric oxide, uses  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT 56450-21-6P, Aluminum copper zinc oxide  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT 67-56-1, Methanol, processes  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT 1333-74-0P, Hydrogen, uses  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)
- IT 124-38-9, Carbon dioxide, formation (nonpreparative)  
630-08-0, Carbon monoxide, formation (nonpreparative)  
(influence of prepn. method on performance of copper/zinc-based **catalysts** for low-temp. steam **reforming** and oxidative steam **reforming** of methanol for hydrogen prodn. for **fuel cells**)

- 138:240537 CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalysts** prepared by impregnation and coprecipitation methods. Tanaka, Yohei; Utaka, Toshimasa; Kikuchi, Ryuji; Sasaki, Kazunari; Eguchi, Koichi (Interdisciplinary Graduate School of Engineering Sciences, Department of Molecular and Material Sciences, Kyushu University, Kasuga-shi, Fukuoka, 816-8580, Japan). Applied Catalysis, A: General, 238(1), 11-18 (English) 2003. CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier Science B.V..
- AB A compn. of Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalysts** prepd. by the impregnation method was optimized for water gas shift reaction (WGSR) coupled with CO oxidn. in the reformed gas. The optimum compn. of the impregnated **catalyst** for high WGSR activity was 5 wt.% Cu/5 wt.% ZnO/Al<sub>2</sub>O<sub>3</sub>. The optimum loading amts. of Cu and ZnO in the impregnated **catalyst** were smaller than those in the copptd. **catalyst**. Its **catalytic** activity above 200.degree.C was comparable to that of the conventional copptd. Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalyst**. However, the activity of the impregnated Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalysts** was significantly lowered at 150.degree.C, whereas no deactivation was obsd. for the copptd. **catalyst** at the same temp. Deactivation occurred over impregnated **catalysts** with H<sub>2</sub>O and/or O<sub>2</sub> in the reaction **gas**; it prevented CO adsorption on the surface.
- IT 7440-50-8, Copper, uses  
(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalysts** prepd. by impregnation and copptn. methods)
- RN 7440-50-8 HCA
- CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)
- Cu
- IT 1333-74-0P, Hydrogen, preparation  
(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalysts** prepd. by impregnation and copptn. methods)
- RN 1333-74-0 HCA
- CN Hydrogen (8CI, 9CI) (CA INDEX NAME)
- H-H
- IT 630-08-0, Carbon monoxide, processes  
(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub> **catalysts** prepd. by impregnation and copptn. methods)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)
- C≡O+
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell hydrogen carbon  
monoxide removal oxidn catalyst**

IT **Fuel cells**

**Oxidation catalysts**

Water gas shift reaction

(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub>

**catalysts** prepd. by impregnation and copptn. methods)

IT 1314-13-2, Zinc oxide, uses 1344-28-1, Alumina, uses

7440-50-8, Copper, uses

(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub>

**catalysts** prepd. by impregnation and copptn. methods)

IT 1333-74-0P, Hydrogen, preparation

(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub>

**catalysts** prepd. by impregnation and copptn. methods)

IT 630-08-0, **Carbon monoxide,  
processes**

(CO removal from reformed fuel over Cu/ZnO/Al<sub>2</sub>O<sub>3</sub>

**catalysts** prepd. by impregnation and copptn. methods)

L52 ANSWER (6) OF 27 HCA COPYRIGHT 2003 ACS on STN

138:224013 Methanol reforming apparatus. Kimata, Fumikazu; Konagai, Nobutoshi; Yamamoto, Kosei (Suzuki Motor Corporation, Japan). U.S. Pat. Appl. Publ. US 2003049184 A1 20030313, 18 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-234239 20020905. PRIORITY: JP 2001-275912 20010912.

AB A compact, highly efficient methanol reforming app. having a stacked structure of thin sheets consists of a reforming section to produce hydrogen and CO, a combustion section with a combustion **catalyst** for supplying heat to the reforming section, and an oxidn. section for oxidizing CO to CO<sub>2</sub>. An evapn. section is installed in front of the reforming section. The thin sheets comprise multiple pairs of passages, and spacers provided with multiple fluid channels. The oxidn. section is cooled by **air** which is also utilized for the methanol combustion. The compact reforming app. can be used to produce hydrogen as **fuel for fuel cells** in automobiles.

IT 1333-74-0P, Hydrogen, uses  
(fuel; methanol reforming app.)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0P, **Carbon monoxide**, preparation  
(methanol reforming app.)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

- IT 7440-50-8, Copper, uses  
(reforming **catalyst**; methanol reforming app.)
- RN 7440-50-8 HCA
- CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)
- Cu
- IC ICM B01J008-04  
ICS F28D021-00
- NCL 422188000; 422193000; 422198000
- CC 51-11 (Fossil Fuels, Derivatives, and Related Products)  
Section cross-reference(s): 52, 67
- ST methanol reforming app hydrogen **fuel cell**
- IT Combustion **catalysts**  
**Fuel cells**  
Oxidation  
**Oxidation catalysts**  
Reforming apparatus  
Reforming **catalysts**  
(methanol reforming app.)
- IT 1344-28-1, Alumina, uses  
(**catalyst** support; methanol reforming app.)
- IT 7440-06-4, Platinum, uses  
(combustion and **oxidn. catalyst**; methanol reforming app.)
- IT 1333-74-0P, Hydrogen, uses  
(fuel; methanol reforming app.)
- IT 630-08-0P, **Carbon monoxide**, preparation  
(methanol reforming app.)
- IT 7440-18-8, Ruthenium, uses  
(**oxidn. catalyst**; methanol reforming app.)
- IT 7440-50-8, Copper, uses 7440-66-6, Zinc, uses  
(reforming **catalyst**; methanol reforming app.)
- L52 ANSWER (7) OF 27 HCA COPYRIGHT 2003 ACS on STN w
- 138:173248 **Catalytic** activities and polarization characteristics of LSM and NiO electrodes used in solid oxide electrolyte cell reactors. Wang, Shuqiang; Awano, Masanobu; Maeda, Kunihiro (Synergy Ceramics Laboratory, FCRA, Shidami Human Science Park, Nagoya, 463-8687, Japan). Proceedings - Electrochemical Society, 2000-22 (Power Sources for the New Millennium), 134-141 (English) 2001. CODEN: PESODO. ISSN: 0161-6374. Publisher: Electrochemical Society.
- AB The **catalytic** activity and polarization of La<sub>0.8</sub>Sr<sub>0.2</sub>MnO<sub>3</sub> (LSM) and NiO electrodes used in single-chamber solid oxide **fuel cells** were studied. The NiO electrode was a better **catalyst** for methane **oxidn.** than the LSM electrode. However, the reactions were depressed at both electrodes when the vol. ratio CH<sub>4</sub>:O<sub>2</sub> increased from 1:1 to 2.5:1. The difference in **catalytic** activity between the LSM and NiO electrodes could be controlled by changing the flow rate and

compn. of the gas or by adding other oxides to the electrodes. Sufficient EMF could be generated with single-chamber cells to directly use methane-air gas mixts.

- IT 630-08-0, Carbon monoxide, formation  
(nonpreparative) 1333-74-0, Hydrogen, formation  
(nonpreparative)  
(catalytic activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide fuel cells fueled with different methane-oxygen mixts.)
- RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{C}\equiv\text{O}^+$

- RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

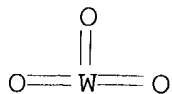
- IT 7782-44-7, Oxygen, uses  
(catalytic activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide fuel cells fueled with different methane-oxygen mixts.)
- RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$\text{O}=\text{O}$

- IT 1307-96-6, Cobaltous oxide, uses 1309-37-1, Ferric oxide, uses 1314-35-8, Tungsten oxide (WO<sub>3</sub>), uses 12037-01-3, Terbium oxide (Tb<sub>4</sub>O<sub>7</sub>)  
(catalytic activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes with added oxides in solid oxide fuel cells)
- RN 1307-96-6 HCA  
CN Cobalt oxide (CoO) (8CI, 9CI) (CA INDEX NAME)

$\text{Co}=\text{O}$

- RN 1309-37-1 HCA  
CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)  
\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*  
RN 1314-35-8 HCA  
CN Tungsten oxide (WO<sub>3</sub>) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



- RN 12037-01-3 HCA  
 CN Terbium oxide (Tb4O7) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)  
 \*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 ST lanthanum manganese strontium oxide cathode **fuel cell**; nickel oxide anode **fuel cell**; methane **catalytic oxidn fuel cell** electrode  
 IT **Fuel cell** anodes  
     **Fuel cell** cathodes  
     (**catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide **fuel cells fueled** with different methane-oxygen mixts.)  
 IT 1313-99-1, Nickel oxide (NiO), uses  
     (anode; **catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide **fuel cells fueled** with different methane-oxygen mixts.)  
 IT 124-38-9, Carbon dioxide, formation (nonpreparative)  
     **630-08-0, Carbon monoxide**, formation (nonpreparative) **1333-74-0, Hydrogen**, formation (nonpreparative)  
     (**catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide **fuel cells fueled** with different methane-oxygen mixts.)  
 IT 74-82-8, Methane, uses **7782-44-7, Oxygen**, uses  
     (**catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide **fuel cells fueled** with different methane-oxygen mixts.)  
 IT 1306-38-3, Ceria, uses **1307-96-6, Cobaltous oxide**, uses **1309-37-1, Ferric oxide**, uses 1312-43-2, Indium oxide (In2O3) 1313-13-9, Manganese oxide (MnO2), uses 1313-97-9, Neodymium oxide (Nd2O3) **1314-35-8, Tungsten oxide (WO3)**, uses 12030-49-8, Iridium oxide (IrO2) 12036-10-1, Ruthenium oxide (RuO2) **12037-01-3, Terbium oxide (Tb4O7)** 12037-29-5, Praseodymium oxide (Pr6O11) 13463-67-7, Titanium oxide (TiO2), uses 55575-02-5, Cerium gadolinium oxide 64417-98-7, Yttrium zirconium oxide  
     (**catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes with added oxides in solid oxide **fuel cells**)  
 IT 108916-22-9, Lanthanum manganese strontium oxide (La0.8MnSr0.2O3) (cathode; **catalytic** activity and polarization

characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes in solid oxide **fuel cells** fueled with different methane-oxygen mixts.)

IT 1314-23-4, Zirconium oxide (ZrO<sub>2</sub>), uses (yttria stabilized; **catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes with added oxides in solid oxide **fuel cells**)

IT 1314-36-9, Yttrium oxide (Y<sub>2</sub>O<sub>3</sub>), uses (zirconia stabilized with; **catalytic** activity and polarization characteristics of lanthanum manganese strontium oxide and nickel oxide electrodes with added oxides in solid oxide **fuel cells**)

L52 ANSWER (8) OF 27 HCA COPYRIGHT 2003 ACS on STN

138:108779 **Oxygen-assisted water gas** shift reactor

having a supported **catalyst**, and method for its use. Zhu, Tianli; Silver, Ronald G.; Emerson, Sean C.; Bellows, Richard J. (USA). U.S. Pat. Appl. Publ. US 2003026747 A1 20030206, 10 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-919290 20010731.

AB A shift converter, or reactor, in a fuel processing subsystem, as for a **fuel cell**, uses an improved **catalyst** bed and the addn. of oxygen to reduce the amt. of **carbon monoxide** in a process gas stream. The **catalyst** of bed is a metal, preferably a noble metal, having a promoted support of metal oxide, preferably ceria and/or zirconia. A water gas shift reaction converts **carbon monoxide** to carbon dioxide. The **oxygen** may be introduced as air, and causes an improvement in **carbon monoxide** removal. Use of the added oxygen enables the shift reactor and its **catalyst** bed to be relatively more compact for performing a given level of **carbon monoxide** conversion. The **catalyst** bed obviates the requirement for prior reducing of **catalysts**, and minimizes the need to protect the **catalyst** from oxygen during operation and/or shutdown.

IT 7439-89-6, Iron, uses

(**oxygen-assisted water gas** shift reactor having supported **catalyst**, and method for its use)

RN 7439-89-6 HCA

CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

IT 1333-74-0P, Hydrogen, processes

(**oxygen-assisted water gas** shift reactor having supported **catalyst**, and method for its use)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)



H-H

IT 630-08-0, Carbon monoxide,  
 processes 7782-44-7, Oxygen,  
 processes  
 (oxygen-assisted water gas shift reactor  
 having supported catalyst, and method for its use)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC ICM B01J008-04  
 NCL 422190000  
 CC 47-1 (Apparatus and Plant Equipment)  
 Section cross-reference(s): 49, 52  
 ST oxygen assisted water gas shift reactor  
 supported catalyst  
 IT Catalyst supports  
 Fuel cells  
 Oxidation  
 Reactors  
 Water gas shift reaction  
 Water gas shift reaction catalysts  
 (oxygen-assisted water gas shift reactor  
 having supported catalyst, and method for its use)  
 IT Noble metals  
 Oxides (inorganic), uses  
 Platinum-group metals  
 (oxygen-assisted water gas shift reactor  
 having supported catalyst, and method for its use)  
 IT 1314-23-4, Zirconium oxide (ZrO<sub>2</sub>), uses 7439-89-6, Iron,  
 uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses  
 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6,  
 Rhodium, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses  
 7440-57-5, Gold, uses 11129-18-3, Cerium oxide  
 (oxygen-assisted water gas shift reactor  
 having supported catalyst, and method for its use)  
 IT 1333-74-0P, Hydrogen, processes  
 (oxygen-assisted water gas shift reactor  
 having supported catalyst, and method for its use)  
 IT 124-38-9, Carbon dioxide, processes 630-08-0,  
 Carbon monoxide, processes 7732-18-5,

Water, processes 7782-44-7, Oxygen,  
processes

(oxygen-assisted water gas shift reactor  
having supported catalyst, and method for its use)

L52 ANSWER 9 OF 27 HCA COPYRIGHT 2003 ACS on STN  
137:203987 Carbon monoxide selective

oxidizing catalyst and its manufacture. Kurachi,  
Saeko (Toyota Jidosha Kabushiki Kaisha, Japan). U.S. Pat. Appl.  
Publ. US 2002122755 A1 20020905, 25 pp. (English). CODEN: USXXCO.  
APPLICATION: US 2002-86806 20020304. PRIORITY: JP 2001-60060  
20010305.

AB This CO selective oxidizing catalyst includes a  
carrier of ferrierite or ZSM-5 that supports a metal component of Pt  
alone or Pt and at least one type of transition metal.  
Alternatively, a CO selective oxidizing catalyst  
includes a carrier whose max. pore diam. ranges from 0.55 to 0.65 nm  
and it supports Pt or Pt and at least one type of transition metal.  
Hydrogen-rich gas contg. CO is presented  
to this catalyst which promotes CO oxidn. in preference to  
H oxidn. The catalyst is manufd. through redn.  
processing.

IT 7439-89-6, Iron, uses 7440-48-4, Cobalt, uses  
7440-50-8, Copper, uses  
(carbon monoxide selective oxidizing  
catalyst)

RN 7439-89-6 HCA  
CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

RN 7440-48-4 HCA  
CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

RN 7440-50-8 HCA  
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0, Hydrogen, uses  
(carbon monoxide selective oxidizing  
catalyst)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
7782-44-7, Oxygen, reactions  
(carbon monoxide selective oxidizing catalyst)  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{-C}\equiv\text{O}^+$

RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

$\text{O}=\text{O}$

IC ICM B01D053-62  
NCL 422187000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67  
ST selective oxidizing catalyst carbon monoxide pore redn processing  
IT Fuel cells  
Pore size  
(carbon monoxide selective oxidizing catalyst)  
IT A zeolites  
Beta zeolites  
Ferrierite-type zeolites  
Mordenite-type zeolites  
Ultrastable Y zeolites  
Zeolite ZSM-5  
(carbon monoxide selective oxidizing catalyst)  
IT Reduction  
(carbon monoxide selective oxidizing catalyst manuf. through redn. processing)  
IT Oxidation catalysts  
(selective; carbon monoxide selective oxidizing catalyst)  
IT 1344-28-1, Alumina, uses 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7439-96-5, Manganese, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses  
(carbon monoxide selective oxidizing catalyst)  
IT 124-38-9, Carbon dioxide, uses 1333-74-0, Hydrogen, uses  
(carbon monoxide selective oxidizing catalyst)

IT 630-08-0, Carbon monoxide, reactions  
7782-44-7, Oxygen, reactions  
(carbon monoxide selective oxidizing  
catalyst)

*Ag composite oxides*

L52 ANSWER (10) OF 27 HCA COPYRIGHT 2003 ACS on STN  
136:281859 Selective **carbon monoxide** oxidation over  
Ag-based composite oxides. Guldur, Cigdem; Balikci, Filiz (Chemical  
Engineering Department, Gazi University, Maltepe, Ankara, 06570,  
Turk.). International Journal of Hydrogen Energy, Volume Date 2002,  
27(2), 219-224 (English) 2001. CODEN: IJHEDX. ISSN: 0360-3199.  
Publisher: Elsevier Science Ltd..

AB We report our results of the synthesis of 1:1 molar ratio of the  
silver cobalt and silver manganese composite oxide **catalysts**  
to remove **carbon monoxide** from hydrogen-rich  
fuels by the **catalytic oxidn.** reaction.  
**Catalysts** were synthesized by the co-pptn. method. XRD,  
BET, TGA, **catalytic** activity and **catalyst**  
deactivation studies were used to identify active **catalysts**  
. Both CO oxidn. and selective CO oxidn. were carried out in a  
microreactor by using a reaction gas mixt. of 1 vol% CO in  
**air** and another gas mixt. was prepd. by mixing 1 vol% CO, 2  
vol% O<sub>2</sub>, 84 vol% H<sub>2</sub>, the balance being He. 15  
vol% CO<sub>2</sub> was added to the reactant gas mixt. in order to det. the  
effect of CO<sub>2</sub>, reaction gases were passed through the humidifier to  
det. the effect of the water vapor on the oxidn. reaction. Metal  
oxide base was decompd. to the metallic phase and surface areas of  
the **catalysts** were decreased when the calcination temp.  
increased from 200.degree.C to 500.degree.C. Ag/Co composite oxide  
**catalyst** calcined at 200.degree.C gave good activity at low  
temps. and 90% of CO conversion at 180.degree.C was obtained for the  
selective CO oxidn. reaction. The addn. of the impurities (CO<sub>2</sub> or  
H<sub>2</sub>O) decreased the activity of **catalyst** for selective CO  
oxidn. in order to get highly rich hydrogen fuels.

IT 7440-48-4, Cobalt, uses  
(selective **carbon monoxide** oxidn. over  
Ag-based composite oxides)

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 630-08-0, Carbon monoxide, processes  
(selective **carbon monoxide** oxidn. over  
Ag-based composite oxides)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST **fuel cell carbon monoxide**  
oxidn catalyst silver cobalt manganese  
IT **Fuel cells**  
Oxidation catalysts  
(selective **carbon monoxide** oxidn. over  
Ag-based composite oxides)  
IT 7439-96-5, Manganese, uses 7440-22-4, Silver, uses  
7440-48-4, Cobalt, uses  
(selective **carbon monoxide** oxidn. over  
Ag-based composite oxides)  
IT 124-38-9, Carbon dioxide, processes 630-08-0,  
**Carbon monoxide**, processes 7732-18-5, Water,  
processes  
(selective **carbon monoxide** oxidn. over  
Ag-based composite oxides)
- L52 ANSWER 11 OF 27 HCA COPYRIGHT 2003 ACS on STN B0  
135:79449 Production of hydrogen for **fuel cell** by  
using heat-resistant steam-reforming catalyst.  
Kushita, Yasuhiro; Hirose, Shigeyuki; Hiramatsu, Yasushi; Yoneoka,  
Mikio; Isobe, Shoshi; Naka, Takahiro; Kuma, Hideaki; Koyama,  
Masataka (Mitsubishi Gas Chemical Co., Ltd., Japan; Honda Motor Co.,  
Ltd.). Jpn. Kokai Tokkyo Koho JP 2001185192 A2 20010706, 6 pp.  
(Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-373630 19991228.
- AB Methanol is allowed to react with steam and **air** in the  
presence of steam **reforming catalyst** for  
producing **H-based gas**. In the prodn., the  
**catalyst** mainly comprises Cu oxide and Zn oxide and also  
contains oxide of Zr compd. Alternatively, the **catalyst**  
comprises a precursor mixt. of Cu compd. and Zn compd. contg. Zr  
compd., and the compds. can change to oxides by being fired. The  
**catalyst** has high heat resistance and **reforming**  
activity, and **H-based gas** with low **CO**  
content can be produced in high efficiency.
- IT 1317-38-0P, Copper oxide (CuO), uses  
(steam **reforming** of methanol for prodn. of H for  
**fuel cell** by using heat-resistant  
**catalyst**)
- RN 1317-38-0 HCA  
CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)
- Cu=O
- IT 1333-74-0P, Hydrogen, preparation  
(steam **reforming** of methanol for prodn. of H for  
**fuel cell** by using heat-resistant  
**catalyst**)
- RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

- IC ICM H01M008-06  
ICS B01J023-80; C01B003-32
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 49, 57, 67
- ST **fuel cell** hydrogen prodn steam **reforming catalyst** heat resistance; copper zinc zirconium oxide steam **reforming catalyst**
- IT **Fuel cells**  
Fuel gas manufacturing  
Heat-resistant materials  
Steam **reforming catalysts**  
(steam **reforming** of methanol for prodn. of H for **fuel cell** by using heat-resistant **catalyst**)
- IT 7758-98-7, Copper sulfate, uses 14644-61-2, Zirconium sulfate (precursor; steam **reforming** of methanol for prodn. of H for **fuel cell** by using heat-resistant **catalyst**)
- IT 1314-13-2P, Zinc oxide (ZnO), uses 1314-23-4P, Zirconium oxide (ZrO<sub>2</sub>), uses 1317-38-0P, Copper oxide (CuO), uses 190586-31-3P, Copper zinc zirconium oxide (steam **reforming** of methanol for prodn. of H for **fuel cell** by using heat-resistant **catalyst**)
- IT 1333-74-0P, Hydrogen, preparation (steam **reforming** of methanol for prodn. of H for **fuel cell** by using heat-resistant **catalyst**)
- IT 67-56-1, Methanol, reactions (steam **reforming** of methanol for prodn. of H for **fuel cell** by using heat-resistant **catalyst**)
- L52 ANSWER 12 OF 27 HCA COPYRIGHT 2003 ACS on STN  
135:79052 Process for selective oxidation of **carbon monoxide** in a **hydrogen** containing **stream** for **fuel cell** feedstock. Brown, Scott (Phillips Petroleum Co., USA). PCT Int. Appl. WO 2001047806 A1 20010705, 16 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US42050 20001110. PRIORITY: US 1999-473157 19991228.
- AB A process for the selective oxidn. of CO to CO<sub>2</sub> in a hydrogen feed

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(in the presence of **catalyst** contg. platinum and iron) involves: (1) mixing an amt. of free O with the **gaseous** mixt. comprising H and CO to provide an O to CO mol ratio of 0.5-8.0 mol O/mol CO to form a second gaseous mixt. and (2) contacting the second gaseous mixt. at 0-300.degree. with an acid treated **catalyst** comprising Pt and Fe impregnated on a support material thereby substantially completely converting CO in the second gaseous mixt. to CO<sub>2</sub>. The **catalyst** can be acid treated.

IT 7439-89-6, Iron, uses  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for **fuel cell** feedstock)

RN 7439-89-6 HCA

CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

IT 1333-74-0P, Hydrogen, preparation  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for **fuel cell** feedstock)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for **fuel cell** feedstock)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

IC ICM C01B031-20  
CC 49-10 (Industrial Inorganic Chemicals)  
Section cross-reference(s): 52

ST **fuel cell** selective oxidn **carbon monoxide** hydrogen

IT **Fuel cells**  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for **fuel cell** feedstock)

IT Oxidation

Oxidation **catalysts**

(selective; process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream**)

- ★
- for fuel cell feedstock)
  - IT 7439-89-6, Iron, uses 7440-06-4, Platinum, uses  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)
  - IT 1344-28-1, Alumina, uses 11137-98-7, Magnesium aluminate  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)
  - IT 124-38-9, Carbon dioxide, formation (nonpreparative)  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)
  - IT 14024-18-1, Ferric acetylacetonate 15170-57-7, Platinum(II) acetylacetonate  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)
  - IT 7697-37-2, Nitric acid, processes  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)
  - IT 1333-74-0P, Hydrogen, preparation  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)
  - IT 630-08-0, Carbon monoxide, reactions  
(process for selective oxidn. of **carbon monoxide** in **hydrogen** contg. **stream** for fuel cell feedstock)

L52 ANSWER (13) OF 27 HCA COPYRIGHT 2003 ACS on STN

134:210589 Method for preparation of **catalytic** material for selective oxidation for **fuel cell** use.

Korotkikh, Olga; Farrauto, Robert J.; McFarland, Andrew (Engelhard Corporation, USA). PCT Int. Appl. WO 2001017681 A2 20010315, 70 pp.  
DESIGNATED STATES: W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US23821 20000830. PRIORITY: US 1999-392813 19990909.

AB The invention pertains to the prepn. and use of **catalytic** materials and **catalyst** members for the selective oxidn. of **carbon monoxide** in a gas **stream** that contains **hydrogen**. One such **catalyst** member may be produced by depositing by elec. arc spraying a metal feedstock onto a metal substrate to provide a metal anchor layer on the substrate, and depositing a **catalytic** material comprising

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pt/Fe?



platinum and iron dispersed on a refractory inorg. oxide support material onto the metal substrate. The **catalytic** material may optionally be produced by wetting the support material, esp. a particulate support material, with a platinum group metal soln. and iron soln. and drying and calcining the wetted support material in air at a temp. in the range of from 200.degree. to 300.degree., preferably using a soln. contg. bivalent platinum ion species. The **catalyst** member may be used by flowing the gas stream there-through at a temp. of about 90.degree. with an O<sub>2</sub>:CO ratio of about 1:1 and a space velocity of about 20,000/h or, alternatively, at a temp. of about 150.degree. with an O<sub>2</sub>:CO ratio of about 1.5:1 and a space velocity of about 80,000/h.

IT 7439-89-6, Iron, uses  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)  
 RN 7439-89-6 HCA  
 CN Iron (7CI, 8CI, 9CI) (CA INDEX NAME)

Fe

IT 1333-74-0P, Hydrogen, uses  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
 7782-44-7, Oxygen, reactions  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$\text{-C}\equiv\text{O}^+$

RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

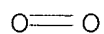
$\text{O}=\text{O}$

IC ICM B01J037-08  
 ICS B01J023-89; B01D053-86  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 67  
 ST **catalyst** prepn selective oxidn **fuel cell**



- IT **Fuel cells**  
 Fuel gases  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)
- IT Oxidation  
 Oxidation **catalysts**  
 (selective; method for prepn. of **catalytic** material for  
 selective oxidn. for **fuel cell** use)
- IT 7439-89-6, Iron, uses 7440-06-4, Platinum, uses  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)
- IT 1344-28-1, Alumina, uses  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)
- IT 1333-74-0P, Hydrogen, uses  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)
- IT 630-08-0, Carbon monoxide, reactions  
 7782-44-7, Oxygen, reactions 12704-83-5, Nickel aluminide  
 (method for prepn. of **catalytic** material for selective  
 oxidn. for **fuel cell** use)
- L52 ANSWER (14) OF 27 HCA COPYRIGHT 2003 ACS on STN  $Cu/Al_2O_3-ZnO$   
 133:225483 Removal of CO from reformed fuel by shift reaction and  
 selective oxidation. Utaka, Toshimasa; Eguchi, Koichi; Sekizawa,  
 Koshi; Sasaki, Kazunari (Kyushu Univ., Japan). Society of  
 Automotive Engineers, [Special Publication] SP, SP-1545 (State of  
 Alternative Fuel Technologies 2000), 95-96 (English) 2000. CODEN:  
 SAESA2. ISSN: 0099-5908. Publisher: Society of Automotive  
 Engineers.
- AB Cu-based and noble metal **catalysts** for CO removal from  
 methanol reformed gas were investigated for application to polymer  
 electrolyte **fuel cells**. Over Cu-based  
**catalysts**, oxygen-assisted low-temp. CO shift reaction  
 (combined shift reaction and CO oxidn.) enhanced CO removal  
 considerably by the addn. of a small amt. of oxygen. While the  
 Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO **catalyst** exhibited a comparable activity with  
 noble metal **catalysts** at low CO concn., it demonstrated a  
 higher activity than Pt/Al<sub>2</sub>O<sub>3</sub> at high CO concn.
- IT 7440-50-8, Copper, uses  
 (removal of CO from reformed fuel by shift reaction and selective  
 oxidn.)
- RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)
- Cu
- IT 7782-44-7, Oxygen, uses  
 (removal of CO from reformed fuel by shift reaction and selective  
 oxidn.)
- RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)



IT 1333-74-0P, Hydrogen, uses  
(removal of CO from reformed fuel by shift reaction and selective oxidn.)

RN 1333-74-0 HCA

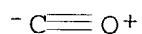
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)



IT 630-08-0, Carbon monoxide,  
**processes**  
(removal of CO from reformed fuel by shift reaction and selective oxidn.)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67

ST **fuel cell** methanol reformed gas **carbon monoxide** removal; **oxidn catalyst carbon monoxide** removal methanol reformed gas; shift reaction **carbon monoxide** removal methanol reformed gas

IT **Fuel cells**

Fuel **gases**

Oxidation

**Oxidation catalysts**

Water gas shift reaction

Water gas shift reaction **catalysts**

(removal of CO from reformed fuel by shift reaction and selective oxidn.)

IT 1314-13-2, Zinc oxide, uses 1344-28-1, Alumina, uses

**7440-50-8**, Copper, uses

(removal of CO from reformed fuel by shift reaction and selective oxidn.)

IT 7440-06-4, Platinum, uses 7440-18-8, Ruthenium, uses 7631-86-9, Silica, uses **7782-44-7**, Oxygen, uses  
(removal of CO from reformed fuel by shift reaction and selective oxidn.)

IT 1333-74-0P, Hydrogen, uses

(removal of CO from reformed fuel by shift reaction and selective oxidn.)

IT 630-08-0, Carbon monoxide,  
**processes**

(removal of CO from reformed fuel by shift reaction and selective oxidn.)

L52 ANSWER 15 OF 27 HCA COPYRIGHT 2003 ACS on STN

132:336440 Method and **catalyst** for converting **carbon**

**monoxide** in manufacture of hydrogen. Eguchi, Koichi; Sekisawa, Koshi; Utaka, Toshimasa; Yano, Seiichi; Arai, Hiromichi (Idemitsu Kosan Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2000143209 A2 20000523, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-314203 19981105.

AB The method is carried out by contacting CO with steam and oxygen in the presence of **catalyst** contg. Cu; Al; and .gtoreq.1 metal oxides selected from ZnO; Cr oxide and MgO, to decrease CO concn. for producing H<sub>2</sub>-rich gas used in **fuel cells**.

IT 7440-50-8, Copper, uses  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0P, Hydrogen, preparation  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen, processes  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, Carbon monoxide, processes  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

IC ICM C01B003-48

*Cu + other stuff*

- ICS B01J021-02; B01J021-10; B01J023-06; B01J023-26; H01M008-06;  
B01J023-72
- CC 49-1 (Industrial Inorganic Chemicals)  
Section cross-reference(s): 52
- ST **oxidn catalyst carbon monoxide**  
hydrogen producing; **fuel cell hydrogen**  
**carbon monoxide catalyst**
- IT **Fuel cells**  
**Oxidation catalysts**  
Steam  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)
- IT Oxides (inorganic), uses  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)
- IT 1309-48-4, Magnesium oxide (MgO), uses 1314-13-2, Zinc oxide (ZnO), uses 7429-90-5, Aluminum, uses 7440-50-8, Copper, uses 11118-57-3, Chromium oxide  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)
- IT 1333-74-0P, Hydrogen, preparation  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)
- IT 7782-44-7, **Oxygen, processes**  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)
- IT 630-08-0, **Carbon monoxide, processes**  
(method and **catalyst** for converting **carbon monoxide** in manuf. of hydrogen)
- L52 ANSWER 16 OF 27 HCA COPYRIGHT 2003 ACS on STN  
132:210135 CO removal by **oxygen-assisted water gas**  
shift reaction over supported Cu **catalysts**. Utaka, T.; Sekizawa, K.; Eguchi, K. (Graduate School of Engineering Sciences, Department of Molecular and Material Sciences, Kyushu University, Kasuga, Fukuoka, Japan). Applied Catalysis, A: General, 194-195, 21-26 (English) 2000. CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier Science B.V..
- AB Supported Cu **catalysts** were investigated for CO removal in a gas mixt. after methanol steam reforming. Removal of CO in the post-reforming gas was effectively promoted by the addn. of **oxygen** in the **gas** mixt. Not only water gas shift reaction (WGSR;  $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$ ) but also CO oxidn. reaction ( $\text{CO} + 1/2\text{O}_2 \rightarrow \text{CO}_2$ ) was effective in reducing the CO concn. Although, **H2** oxidn. also proceeded by added oxygen, the concn. of CO significantly decreased without consuming a large amt. of **H2** with an increase in oxygen concn. The equil. concn. obtained from thermodyn. data indicates that the reaction is desirable at lower temps. Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO demonstrated an excellent activity for **catalytic** removal of CO by oxygen-assisted WGSR. The activity was enhanced without increasing **H2** conversion by employing longer contact time. These

results indicate that the design of an active shift/oxidn. **catalyst** operative at 100-150.degree. is a possible method for removal of very small amts. of CO in the reformed fuel.

IT 7440-50-8, Copper, uses  
 (carbon monoxide removal by oxygen  
 -assisted water gas shift reaction over supported Cu  
 catalysts)  
 RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 7782-44-7, Oxygen, uses  
 (carbon monoxide removal by oxygen  
 -assisted water gas shift reaction over supported Cu  
 catalysts)  
 RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, Carbon monoxide, processes  
 (carbon monoxide removal by oxygen  
 -assisted water gas shift reaction over supported Cu  
 catalysts)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 67

ST fuel cell methanol steam reforming; water gas  
 shift reaction carbon monoxide removal; reformed  
 fuel carbon monoxide removal

IT Oxidation  
 (CO; carbon monoxide removal by  
 oxygen-assisted water gas shift reaction over  
 supported Cu catalysts)

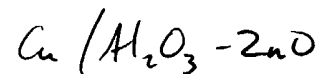
IT Oxidation catalysts  
 Water gas shift reaction  
 Water gas shift reaction catalysts  
 (carbon monoxide removal by oxygen  
 -assisted water gas shift reaction over supported Cu  
 catalysts)

IT Fuel cells  
 (polymer electrolyte; carbon monoxide removal  
 by oxygen-assisted water gas shift reaction  
 over supported Cu catalysts)



- IT Fuel gas manufacturing  
(steam reforming; **carbon monoxide** removal by  
**oxygen**-assisted water **gas** shift reaction over  
supported Cu **catalysts**)
- IT 1309-48-4, Magnesium oxide, uses 1314-13-2, Zinc oxide, uses  
1344-28-1, Alumina, uses 7440-05-3, Palladium, uses 7440-06-4,  
Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium,  
uses **7440-50-8**, Copper, uses 7440-57-5, Gold, uses  
11118-57-3, Chromium oxide 11129-60-5, Manganese oxide  
(**carbon monoxide** removal by **oxygen**  
-assisted water **gas** shift reaction over supported Cu  
**catalysts**)
- IT 124-38-9, Carbon dioxide, formation (nonpreparative)  
(**carbon monoxide** removal by **oxygen**  
-assisted water **gas** shift reaction over supported Cu  
**catalysts**)
- IT 7782-44-7, Oxygen, uses  
(**carbon monoxide** removal by **oxygen**  
-assisted water **gas** shift reaction over supported Cu  
**catalysts**)
- IT 630-08-0, Carbon monoxide, processes  
(**carbon monoxide** removal by **oxygen**  
-assisted water **gas** shift reaction over supported Cu  
**catalysts**)

L52 ANSWER (17) OF 27 HCA COPYRIGHT 2003 ACS on STN



131:324961 Removal of CO from methanol reforming gas by low temperature  
shift reaction. Eguchi, Koichi; Yano, Sei-ichi; Utaka, Toshimasa;  
Sekizawa, Koshi; Arai, Hiromichi (Department of Molecular and  
Material Sciences, Graduate School of, Kyushu University, Fukuoka,  
816-8580, Japan). Studies in Surface Science and Catalysis,  
121 (Science and Technology in Catalysis 1998), 445-448 (English)  
1999. CODEN: SSCTDM. ISSN: 0167-2991. Publisher: Elsevier Science  
B.V..

AB Copper **catalysts** supported on mixed oxides were  
investigated for CO removal in the methanol steam reformed gas.  
Although Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO demonstrated excellent activity for water gas  
shift reaction (WGS; CO + H<sub>2</sub>O -> CO<sub>2</sub> + H<sub>2</sub>), further  
removal of CO in the reformed gas applied as a fuel for polymer  
electrolyte **fuel cells** is required. It is  
difficult to remove trace CO in the reformed gas through WGS,  
however, O<sub>2</sub> addn. to the reformed gas is effective to  
enhance the CO removal through CO oxidn. Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO also  
demonstrated excellent activity for **catalytic** removal of  
CO by WGS and selective CO oxidn. (CO + 1/2 O<sub>2</sub> -> CO<sub>2</sub>). This  
indicates that the design of an active shift/**oxidn.**  
**catalyst** operative at 100-150.degree. is a possible method  
for selective removal of CO in the methanol reforming gas.

- IT **7440-50-8**, Copper, uses  
(Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO; removal of CO from methanol reforming gas by low  
temp. shift reaction)
- RN 7440-50-8 HCA

A

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 630-08-0, Carbon monoxide,  
processes

(removal of CO from methanol reforming gas by low temp.  
shift reaction)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$-C \equiv O^+$

IT 1333-74-0P, Hydrogen, uses

(removal of CO from methanol reforming gas by low temp. shift  
reaction)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67

ST methanol reforming gas **fuel cell**; shift reaction  
methanol reforming gas; **carbon monoxide** removal  
methanol reforming gas

IT **Fuel cells**

(polymer electrolyte; removal of CO from methanol reforming gas  
by low temp. shift reaction)

IT Water gas shift reaction

Water gas shift reaction **catalysts**

(removal of CO from methanol reforming gas by low temp. shift  
reaction)

IT 7440-50-8, Copper, uses

(Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO; removal of CO from methanol reforming gas by low  
temp. shift reaction)

IT 1308-38-9, Chromium oxide cr<sub>2</sub>o<sub>3</sub>, uses 1309-48-4, Magnesia, uses  
(**catalyst** support; removal of CO from methanol  
reforming gas by low temp. shift reaction)

IT 630-08-0, Carbon monoxide,  
processes

(removal of CO from methanol reforming gas by low temp.  
shift reaction)

IT 1333-74-0P, Hydrogen, uses

(removal of CO from methanol reforming gas by low temp. shift  
reaction)

L52 ANSWER (18) OF 27 HCA COPYRIGHT 2003 ACS on STN  
131:118387 **Catalytic** production of hydrogen from methanol for

Ant oxides



**fuel cell** application. Sekizawa, K.; Utaka, T.; Eguchi, K. (Department of Molecular and Materials Sciences, Graduate School of Engineering Sciences, Kyushu University, Kasuga, Fukuoka, 816-8580, Japan). *Kinetics and Catalysis* (Translation of *Kinetika i Kataliz*), 40(3), 411-413 (English) 1999. CODEN: KICAA8. ISSN: 0023-1584. Publisher: MAIK Nauka/Interperiodica Publishing.

AB Copper **catalysts** supported on mixed oxides were investigated in CO removal in the methanol steam reforming gas. It is difficult to remove a trace amt. of CO in the postreforming gas through a water-gas shift reaction due to the kinetic effect, although the high activity at low temps. is a thermodyn. requirement. An addn. of a small amt. of O<sub>2</sub> to the postreforming gas is effective in enhancing CO removal via CO oxidn. The Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO, Cu/Al<sub>2</sub>O<sub>3</sub>-Cr<sub>2</sub>O<sub>3</sub>, and Cu/Al<sub>2</sub>O<sub>3</sub>-MgO **catalysts** demonstrated high activities at 150.degree. in the presence of O<sub>2</sub>. The Cu/Al<sub>2</sub>O<sub>3</sub>-ZnO **catalyst** was the most active of these **catalysts**.

IT 7440-50-8, Copper, uses  
(copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0P, Hydrogen, preparation  
(copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, processes  
(copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67

ST **carbon monoxide** removal steam reforming gas;  
methanol steam reforming **fuel cell**; water gas  
shift reaction **oxidn catalyst**

- IT **Fuel cells**  
**Oxidation catalysts**  
 Synthesis gas  
 Water gas shift reaction **catalysts**  
 (copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)
- IT 1308-38-9, Chromium oxide (Cr<sub>2</sub>O<sub>3</sub>), uses 1309-48-4, Magnesia, uses 7440-50-8, Copper, uses  
 (copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)
- IT 67-56-1, Methanol, miscellaneous 1314-13-2, Zinc oxide, miscellaneous 1344-28-1, Alumina, miscellaneous  
 (copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)
- IT 1333-74-0P, Hydrogen, preparation  
 (copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)
- IT 630-08-0, **Carbon monoxide**, processes  
 (copper **catalysts** supported on mixed oxides for **carbon monoxide** removal from methanol steam reforming gas)
- L52 ANSWER (19) OF 27 HCA COPYRIGHT 2003 ACS on STN  
 131:61183 **Catalyst for oxidation of carbon monoxide in hydrogen gas, especially for fuel cell, its manufacture, and oxidation process.**  
 Eto, Yoshiyuki; Kaneko, Hiroaki (Nissan Motor Co., Ltd., Japan).  
 Jpn. Kokai Tokkyo Koho JP 11165070 A2 19990622 Heisei, 11 pp.  
 (Japanese). CODEN: JKXXAF. APPLICATION: JP 1997-332104 19971202.
- AB The **catalyst** comprises Pt-group metal (e.g., Pd or Ru)-contg. base metal (e.g., Cu) rare earth metal (e.g., Ce or Nd) oxide dispersed in active Al<sub>2</sub>O<sub>3</sub> on a ceramic support. The manuf. consists of adding a mix soln. of Pt-group metal salt, Cu salt, and rare earth metal salt to an octylic acid soln., firing the pptn. in **air** to prep. an oxide, mixing the oxide with active Al<sub>2</sub>O<sub>3</sub> into a slurry, applying the slurry on a ceramic support, and firing in oxidizing atm. at 350-500.degree.. **CO** in **H gas** is oxidized (e.g., at 100-200.degree.) and removed. The purified **H gas** is suitable for fuel gas for a **fuel cell**.
- IT 7440-50-8, Copper, uses  
 (in manuf. of **catalyst** for oxidn. of **carbon monoxide** in hydrogen gas for fuel cell)
- RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

*noble + rare earth*

Cu

IT 1333-74-0P, Hydrogen, uses  
 (manuf. of **catalyst** for oxidn. of  
**carbon monoxide** in hydrogen  
 gas for fuel cell)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
 (manuf. of **catalyst** for oxidn. of  
**carbon monoxide** in hydrogen  
 gas for fuel cell)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM B01J023-89  
 ICS B01D053-94; C01B003-58; C01B031-20; H01M008-06  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 67  
 ST **carbon monoxide oxidn catalyst**  
 manuf; platinum copper rare earth oxide **catalyst**;  
 palladium copper rare earth oxide **catalyst**; ruthenium  
 copper rare earth oxide **catalyst**; cerium copper platinum  
 group oxide **catalyst**; neodymium copper platinum group  
 oxide **catalyst**; **fuel cell**  
**hydrogen gas purifn catalyst**  
 IT **Fuel cells**  
**Oxidation catalysts**  
 (manuf. of **catalyst** for oxidn. of  
**carbon monoxide** in hydrogen  
 gas for fuel cell)  
 IT Rare earth oxides  
 Rare earth oxides  
 (platinum-group metal compds., contg. base metal,  
**catalyst**; manuf. of **catalyst** for oxidn  
 . of **carbon monoxide** in hydrogen  
 gas for fuel cell)  
 IT Platinum-group metal compounds  
 Platinum-group metal compounds  
 (rare earth oxides, contg. base metal, **catalyst**; manuf.  
 of **catalyst** for oxidn. of **carbon**  
**monoxide** in hydrogen gas for  
**fuel cell**)

- IT 1344-28-1, Alumina, uses  
(**catalyst** support; manuf. of **catalyst** for  
oxidn. of **carbon monoxide** in  
**hydrogen gas** for fuel cell)
- IT 7440-05-3, Palladium, uses 7440-18-8, Ruthenium, uses  
(**catalyst**; in manuf. of **catalyst** for  
oxidn. of **carbon monoxide** in  
**hydrogen gas** for fuel cell)
- IT 228088-17-3P, Cerium copper oxide (Ce0.26Cu0.06O3.64)  
228088-21-9P, Cerium copper oxide (Ce0.28Cu0.03O3.64)  
228088-24-2P, Cerium copper oxide (Ce0.28Cu0.03O3.65)  
228088-26-4P, Copper neodymium oxide (Cu0.07Nd0.26O3.58)  
228088-28-6P, Copper neodymium oxide (Cu0.07Nd0.26O3.59)  
228088-31-1P, Copper neodymium oxide (Cu0.03Nd0.28O3.58)  
228088-32-2P, Copper neodymium oxide (Cu0.1Nd0.24O3.65)  
(**catalyst**; manuf. of **catalyst** for  
oxidn. of **carbon monoxide** in  
**hydrogen gas** for fuel cell)
- IT 7440-50-8, Copper, uses  
(in manuf. of **catalyst** for oxidn. of  
**carbon monoxide** in **hydrogen**  
**gas** for fuel cell)
- IT 1333-74-0P, Hydrogen, uses  
(manuf. of **catalyst** for oxidn. of  
**carbon monoxide** in **hydrogen**  
**gas** for fuel cell)
- IT 630-08-0, Carbon monoxide, reactions  
(manuf. of **catalyst** for oxidn. of  
**carbon monoxide** in **hydrogen**  
**gas** for fuel cell)
- IT 3251-23-8 7647-10-1, Palladium chloride (PdCl<sub>2</sub>) 10045-95-1,  
Neodymium nitrate 10108-73-3, Cerium nitrate 13465-52-6,  
Ruthenium chloride (RuCl<sub>4</sub>) 17158-60-0, Sodium octylate  
(prepn. of platinum-group metal-base metal-rare earth metal oxide  
as **catalyst**; manuf. of **catalyst** for  
oxidn. of **carbon monoxide** in  
**hydrogen gas** for fuel cell)

L52 ANSWER (20) OF 27 HCA COPYRIGHT 2003 ACS on STN

130:299256 Kinetics of the Selective Low-Temperature Oxidation of CO in  
**H<sub>2</sub>-Rich Gas** over Au/.alpha.-Fe<sub>2</sub>O<sub>3</sub>. Kahlich, M. J.;  
Gasteiger, H. A.; Behm, R. J. (Abteilung Oberflachenchemie und  
Katalyse, Universitat Ulm, Ulm, D-89069, Germany). Journal of  
Catalysis, 182(2), 430-440 (English) 1999. CODEN: JCTLA5. ISSN:  
0021-9517. Publisher: Academic Press.

AB The selective CO oxidn. (also referred to as PROX) on a  
Au/.alpha.-Fe<sub>2</sub>O<sub>3</sub> **catalyst** in simulated **reformer**  
**gas** (low concns. of CO and O<sub>2</sub>, 75 kPa **H<sub>2</sub>**,  
balance N<sub>2</sub>) at atm. pressure was investigated over almost two orders  
of magnitude in CO partial pressure (0.025-1.5 kPa) and over a large  
range of pO<sub>2</sub>/pCO ratios (0.25-10). Quant. evaluation of CO oxidn.  
rates as a function of CO and O<sub>2</sub> partial pressure at

*A/Fe<sub>2</sub>O<sub>3</sub>*

80.degree.C yields reaction orders with respect to CO and O<sub>2</sub> of 0.55 and 0.27, resp. The apparent activation energy for this reaction evaluated in the temp. range of 40-100.degree.C is 31 kJ/mol. At 80.degree.C, the selectivity, defined as the ratio of oxygen consumption for CO oxidn. to the total oxygen consumption, reaches 75% at large CO partial pressures (1.5 kPa), but decreases significantly with diminishing pCO. This is related to the fact that the H<sub>2</sub> oxidn. rate is independent of the CO partial pressure, consistent with a reaction mechanism where oxygen adsorbed at the metal/metal oxide interface reacts with H and CO adsorbed at low coverages on the supported Au nanoclusters. The selectivity increases with decreasing temp., reflecting a higher apparent activation energy for H<sub>2</sub> oxidn. than for CO oxidn. A comparison with Pt/.gamma.-Al<sub>2</sub>O<sub>3</sub>, a commonly used PROX catalyst with an optimum operating temp. of ca. 200.degree.C, demonstrates that Au/.alpha.-Fe<sub>2</sub>O<sub>3</sub> already offers comparable activity and selectivity at 80.degree.C. (c) 1999 Academic Press.

IT 1309-37-1, Ferric oxide, processes 1333-74-0,  
**Hydrogen, processes**  
 (kinetics of selective low-temp. oxidn. of **carbon monoxide** in **hydrogen-rich gas** over Au/.alpha.-Fe<sub>2</sub>O<sub>3</sub>)

RN 1309-37-1 HCA

CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, **Carbon monoxide**, processes  
 (kinetics of selective low-temp. oxidn. of **carbon monoxide** in **hydrogen-rich gas** over Au/.alpha.-Fe<sub>2</sub>O<sub>3</sub>)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 49, 67

ST **carbon monoxide oxidn catalyst**  
 ; gold iron oxide oxidn catalyst; hydrogen  
**carbon monoxide oxidn fuel cell**

IT **Fuel cells**

**Oxidation catalysts**

Oxidation kinetics

Reaction mechanism

(kinetics of selective low-temp. oxidn. of **carbon**

- monoxide in hydrogen-rich gas over  
Au/.alpha.-Fe2O3)
- IT 7440-57-5, Gold, uses  
(kinetics of selective low-temp. oxidn. of carbon  
monoxide in hydrogen-rich gas over  
Au/.alpha.-Fe2O3)
- IT 1309-37-1, Ferric oxide, processes 1333-74-0,  
Hydrogen, processes  
(kinetics of selective low-temp. oxidn. of carbon  
monoxide in hydrogen-rich gas over  
Au/.alpha.-Fe2O3)
- IT 630-08-0, Carbon monoxide, processes  
(kinetics of selective low-temp. oxidn. of carbon  
monoxide in hydrogen-rich gas over  
Au/.alpha.-Fe2O3)
- L52 ANSWER (21) OF 27 HCA COPYRIGHT 2003 ACS on STN  
129:163846 Preferential oxidation of CO over Pt/.gamma.-Al2O3 and  
Au/.alpha.-Fe2O3: reactor design calculations and experimental  
results. Kahlich, M. J.; Gasteiger, H. A.; Behm, R. J. (Abteilung  
Oberflächenchemie und Katalyse, Universität Ulm, Ulm, D-89069,  
Germany). Journal of New Materials for Electrochemical Systems,  
1(1), 39-46 (English) 1998. CODEN: JMESFQ. ISSN: 1480-2422.  
Publisher: Journal of New Materials for Electrochemical Systems.
- AB We present calcns. of the required oxygen excess and noble metal  
mass together with integral flow expts. for the preferential oxidn.  
(PROX) of CO in simulated reformer gas (1%  
CO, low concns. of O2, 75% H2, balance  
N2) over Pt/.gamma.-Al2O3 at 200.degree. and Au/.alpha.-Fe2O3 at  
80.degree. under different load conditions, i.e., at different  
contact times. The calcns. are based on kinetic data of both  
catalysts detd. in differential flow expts. It is  
demonstrated that these calcns. give realistic values for the min.  
noble metal mass and the oxygen excess required for a desired CO  
conversion. At optimum contact-time, the min. CO exit concn. on a  
Pt/.gamma.-Al2O3 catalyst at 200.degree. was found to be  
60 ppm, increasing to 200 ppm at five-fold higher contact-time.  
This is attributed to the reverse water-gas shift reaction taking  
place as a competing reaction to the selective CO oxidn. over  
Pt/.gamma.-Al2O3. On a Au/.alpha.-Fe2O3 catalyst, the  
min. CO exit concn. of <3 ppm (detection limit) increases to 30 ppm  
by increasing the contact-time by a factor of five. A two-step PROX  
reactor using Pt/.gamma.-Al2O3 in a first stage at 200.degree. to  
oxidize the majority of CO down to .apprx.1000 ppm and  
Au/.alpha.-Fe2O3 in a second stage at 80.degree. is proposed for the  
complete oxidn. of CO under dynamic load conditions.
- IT 1309-37-1, Ferric oxide, uses  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- RN 1309-37-1 HCA  
CN Iron oxide (Fe2O3) (8CI, 9CI) (CA INDEX NAME)
- \*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

A/Fe<sub>2</sub>O<sub>3</sub>

- IT 1333-74-0P, Hydrogen, preparation  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- RN 1333-74-0 HCA
- CN Hydrogen (8CI, 9CI) (CA INDEX NAME)
- H-H
- IT 630-08-0, Carbon monoxide, reactions  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)
- C≡O+
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 67
- ST carbon monoxide oxidn platinum alumina  
catalyst; reformer gas hydrogen  
purifn fuel cell; gold iron oxide  
catalyst oxidn
- IT Reforming apparatus  
(gas from; reactor design calcns. and exptl. results on  
preferential oxidn. of CO over Pt/.gamma.-Al2O3 and  
Au/.alpha.-Fe2O3)
- IT Oxidation catalysts  
Water gas shift reaction  
Water gas shift reaction catalysts  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- IT 1309-37-1, Ferric oxide, uses 1344-28-1, Alumina, uses  
7440-06-4, Platinum, uses 7440-57-5, Gold, uses  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- IT 1333-74-0P, Hydrogen, preparation  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- IT 630-08-0, Carbon monoxide, reactions  
(reactor design calcns. and exptl. results on preferential oxidn.  
of CO over Pt/.gamma.-Al2O3 and Au/.alpha.-Fe2O3)
- L52 ANSWER (22) OF 27 HCA COPYRIGHT 2003 ACS on STN
- 125:63111 Ethanol steam reforming in a molten carbonate  
fuel cell. A preliminary kinetic investigation.  
Cavallaro, S.; Freni, S. (Dip. Chim. Industriale, Univ. Messina, S.  
Agata di Messina, I-98166, Italy). International Journal of  
Hydrogen Energy, 21(6), 465-469 (English) 1996. CODEN: IJHEDX.  
ISSN: 0360-3199. Publisher: Elsevier.
- AB The decompn. of EtOH to COx and H2 was examd. under a wide

range of operating conditions. High pressure reduced  $H_2$ , CO and  $CO_2$  prodn., while high temp. produced the opposite effect. At  $T < 600$  K, the reaction produced **oxygenated** compds. (acetaldehyde, Et acetate, acetic acid etc.) and  $H_2$  yield was reduced. A math. model was used to extrapolate the kinetic findings obtained in the microreactor at atm. pressure to ideal high pressure equipment. The simulation showed the feasibility of the process at temps. 800-1000 K, and pressures .gtoreq.100 bar. The use of a  $CuO/ZnO/Al_2O_3$  **catalyst**, exhibited good activity, and more expensive **catalysts** were unnecessary.

IT 1317-38-0, Copper oxide (cuo), uses  
(ethanol steam **reforming** kinetics in molten carbonate  
fuel cells)  
RN 1317-38-0 HCA  
CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)

$Cu \equiv O$

IT 630-08-0, Carbon monoxide, formation  
(nonpreparative)  
(ethanol steam **reforming** kinetics in molten carbonate  
fuel cells)  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

$-C \equiv O^+$

IT 1333-74-0, Hydrogen, uses  
(ethanol steam **reforming** kinetics in molten carbonate  
fuel cells)  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST **reforming** ethanol molten carbon fuel  
cell  
IT **Reforming catalysts**  
(copper-zinc/alumina; ethanol steam **reforming** kinetics  
in molten carbonate fuel cells)  
IT **Fuel cells**  
(molten carbonate; ethanol steam **reforming** kinetics in  
molten carbonate fuel cells)  
IT Kinetics of **reforming**  
(steam, ethanol steam **reforming** kinetics in molten  
carbonate fuel cells)  
IT 1314-13-2, Zinc oxide (zno), uses 1317-38-0, Copper oxide  
(cuo), uses 1344-28-1, Aluminum oxide ( $Al_2O_3$ ), uses



- (ethanol steam **reforming** kinetics in molten carbonate **fuel cells**)
- IT 124-38-9, Carbon dioxide, formation (nonpreparative)  
630-08-0, Carbon monoxide, formation  
(nonpreparative)  
(ethanol steam **reforming** kinetics in molten carbonate **fuel cells**)
- IT 1333-74-0, Hydrogen, uses  
(ethanol steam **reforming** kinetics in molten carbonate **fuel cells**)
- IT 64-17-5, Ethanol, uses  
(ethanol steam **reforming** kinetics in molten carbonate **fuel cells**)
- L52 ANSWER (23) OF 27 HCA COPYRIGHT 2003 ACS on STN *Viewed - has Au*  
124:207257 Oxidation of CO to CO<sub>2</sub> and manufacture of hydrogen  
-containing **gases** for **fuel cells**.  
Fujimoto, Tatsuya (Idemitsu Kosan Co, Japan). Jpn. Kokai Tokkyo  
Koho JP 07315825 A2 19951205 Heisei, 8 pp. (Japanese). CODEN:  
JKXXAF. APPLICATION: JP 1994-105735 19940519.
- AB CO is converted into CO<sub>2</sub> by selective oxidn. by contacting a  
**gas** mixt. contg. CO, O, and .ltoreq.3 vol%  
impurities of methanol, formic acid, and/or formaldehyde with a  
noble metal **catalysts** (e.g., Au). The CO-contg.  
**gases** may be obtained by **reforming** of methanol.  
The H-contg. **gas** for **fuel**  
**cells** is manufd. by contacting a gas product from methanol  
**reforming** with noble metal **catalysts** for selective  
removal of CO by oxidn. of CO to CO<sub>2</sub>.
- IT 1309-37-1, Ferric oxide, uses  
(converting of **carbon monoxide** in hydrogen  
from methanol **reforming** by selective **catalytic**  
**oxidn.** for **fuel cells**)
- RN 1309-37-1 HCA  
CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)  
\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*
- IT 1333-74-0, Hydrogen, processes  
(converting of **carbon monoxide** in hydrogen  
from methanol **reforming** by selective **catalytic**  
**oxidn.** for **fuel cells**)
- RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)
- H-H
- IT 7782-44-7, Oxygen, reactions  
(converting of **carbon monoxide** in hydrogen  
from methanol **reforming** by selective **catalytic**  
**oxidn.** for **fuel cells**)
- RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 630-08-0, Carbon monoxide, processes  
(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic  
oxidn. for fuel cells)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM C01B031-20

ICS B01J023-89; C01B003-32; C01B003-58; H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST carbon monoxide converting oxidn  
catalyst; hydrogen manuf fuel cell

IT Fuel cells

(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic  
oxidn. for fuel cells)

IT Transition metals, uses

(nobel; converting of carbon monoxide in  
hydrogen from methanol reforming by selective  
catalytic oxidn. for fuel  
cells)

IT Oxidation catalysts

(noble metals; converting of carbon monoxide  
in hydrogen from methanol reforming by selective  
catalytic oxidn. for fuel  
cells)

IT 1309-37-1, Ferric oxide, uses 7440-57-5, Gold, uses  
(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic  
oxidn. for fuel cells)

IT 1333-74-0, Hydrogen, processes

(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic  
oxidn. for fuel cells)

IT 124-38-9P, Carbon dioxide, preparation

(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic  
oxidn. for fuel cells)

IT 7782-44-7, Oxygen, reactions

(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic  
oxidn. for fuel cells)

IT 630-08-0, Carbon monoxide, processes

(converting of carbon monoxide in hydrogen  
from methanol reforming by selective catalytic

- oxidn. for fuel cells)
- IT 64-18-6, Formic acid, miscellaneous 67-56-1, Methanol, miscellaneous  
(impurity; converting of **carbon monoxide** in hydrogen from methanol **reforming** by selective **catalytic oxidn. for fuel cells**)
- IT 50-00-0, Formaldehyde, occurrence  
(impurity; converting of **carbon monoxide** in hydrogen from methanol **reforming** by selective **catalytic oxidn. for fuel cells**)
- L52 ANSWER (24) OF 27 HCA COPYRIGHT 2003 ACS on STN *viewed has Au*  
124:150607 Manufacture of **hydrogen-containing gas** for **fuel cells**. Fujimoto, Tatsuya (Idemitsu Kosan Co, Japan). Jpn. Kokai Tokkyo Koho JP 07309603 A2 19951128 Heisei, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1994-103075 19940517.
- AB In manuf. of the title **H-contg. gases** by **catalytic oxidative** conversion of CO to CO<sub>2</sub> in mixts. of **O-contg. gases** and **reformed gas** mainly contg. CO and CO<sub>2</sub>, the selective oxidn. process is controlled to keep the concns. of O and CO in exhaust **gas** to .gtoreq.0.2 and <2 vol.% and .ltoreq.100 ppm, resp.
- IT 1309-37-1, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), uses  
(manuf. of **hydrogen-contg. gases** for **fuel cells** by **catalytic oxidn. of reformed gas** and **O-contg. gases**)
- RN 1309-37-1 HCA  
CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)  
\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*
- IT 1333-74-0P, Hydrogen, uses  
(manuf. of **hydrogen-contg. gases** for **fuel cells** by **catalytic oxidn. of reformed gas** and **O-contg. gases**)
- RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)
- H-H
- IT 630-08-0, Carbon monoxide, reactions  
(manuf. of **hydrogen-contg. gases** for **fuel cells** by **catalytic oxidn. of reformed gas** and **O-contg. gases**)
- RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

- IC ICM C01B003-50  
ICS C01B003-38; C01B031-20; H01M008-06
- CC 51-6 (Fossil Fuels, Derivatives, and Related Products)  
Section cross-reference(s): 52, 67
- ST **hydrogen** contg **gas** manuf; **catalytic**  
**oxidn** reformed **gas**; **fuel cell**  
**hydrogen gas** manuf
- IT **Fuel cells**  
Fuel gas manufacturing  
(manuf. of **hydrogen**-contg. **gases** for  
**fuel cells** by **catalytic oxidn**  
. of **reformed gas** and **O**-contg.  
**gases**)
- IT 1309-37-1, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), uses 7440-57-5, Gold, uses  
(manuf. of **hydrogen**-contg. **gases** for  
**fuel cells** by **catalytic oxidn**  
. of **reformed gas** and **O**-contg.  
**gases**)
- IT 124-38-9P, Carbon dioxide, uses 1333-74-0P, Hydrogen, uses  
(manuf. of **hydrogen**-contg. **gases** for  
**fuel cells** by **catalytic oxidn**  
. of **reformed gas** and **O**-contg.  
**gases**)
- IT 630-08-0, Carbon monoxide, reactions  
(manuf. of **hydrogen**-contg. **gases** for  
**fuel cells** by **catalytic oxidn**  
. of **reformed gas** and **O**-contg.  
**gases**)
- IT 1344-28-1, Alumina, uses  
(support; manuf. of **hydrogen**-contg. **gases** for  
**fuel cells** by **catalytic oxidn**  
. of **reformed gas** and **O**-contg.  
**gases**)
- L52 ANSWER (25) OF 27 HCA COPYRIGHT 2003 ACS on STN hv  
122:270131 Manufacture of **hydrogen**-containing **gases**  
for **fuel cells**. Kesen, Tadashi; Takase,  
Tsuneyoshi; Matsuhisa, Toshio; Iida, Hiroshi (Idemitsu Kosan Co,  
Japan; Toyo Cci Kk). Jpn. Kokai Tokkyo Koho JP 07048101 A2 19950221  
Heisei, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP  
1993-208195 19930802.
- AB In manuf. of the title gases by selective oxidn. removal of CO from  
mixt. of **O**-contg. **gas** and **CO**-contg.  
**H**-based **gas**, obtained by **reforming** of  
fuels that are convertible into **H**-contg. **fuel gas**  
; the **CO** removal **process** is carried out in  
presence of **Au**-contg. **catalyst** at .gtoreq.2 kg/cm<sup>2</sup>G and  
<10 kg/cm<sup>2</sup>G. The gases show high performance when used in

**fuel cells.**

IT 1309-37-1, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), uses  
(manuf. of H-contg. **gases** for **fuel**  
**cells** by selective oxidn. of CO using gold  
**catalyst**)

RN 1309-37-1 HCA

CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

IT 7782-44-7, Oxygen, uses  
(manuf. of H-contg. **gases** for **fuel**  
**cells** by selective oxidn. of CO using gold  
**catalyst**)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 1333-74-0P, Hydrogen, uses  
(manuf. of H-contg. **gases** for **fuel**  
**cells** by selective oxidn. of CO using gold  
**catalyst**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, reactions  
(manuf. of H-contg. **gases** for **fuel**  
**cells** by selective oxidn. of CO using gold  
**catalyst**)

RN 630-08-0 HCA

CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O<sup>+</sup>

IC ICM C01B003-38

ICS B01D053-94; B01J023-89; B01J035-02; H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 49, 51, 67

ST **hydrogen gas** manuf **fuel cell**  
; **carbon monoxide catalytic**  
**oxidn gas**; gold **catalyst carbon**  
**monoxide oxidn**

IT **Fuel cells**

(**gases** for; manuf. of H-contg. **gases** for  
**fuel cells** by selective oxidn. of CO using gold  
**catalyst**)

IT Hydrocarbon oils

(light; manuf. of H-contg. **gases** for

- fuel cells** by selective oxidn. of CO using gold catalyst)
- IT Fuel **gases**  
Oxidation catalysts  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT Alcohols, **processes**  
Kerosine  
Naphtha  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT Natural gas  
(liquefied, manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT 74-98-6, Propane, **processes**  
(liquefied; manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT 1309-37-1, Iron oxide ( $\text{Fe}_2\text{O}_3$ ), uses 1344-28-1, Alumina, uses 7440-57-5, Gold, uses  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT 7782-44-7, Oxygen, uses  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT 67-56-1, Methanol, **processes** 74-82-8, Methane, **processes** 106-97-8, Butane, **processes**  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT 1333-74-0P, Hydrogen, uses  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- IT 630-08-0, Carbon monoxide, reactions  
(manuf. of H-contg. **gases** for **fuel cells** by selective oxidn. of CO using gold catalyst)
- L52 ANSWER (26) OF 27 HCA COPYRIGHT 2003 ACS on STN 57:16050 Original Reference No. 57:3180i,3181a-e High-temperature carbonate **fuel cells**. Broers, G. H. J.; Ketelaar, J. A. A. Journal of Industrial and Engineering Chemistry (Washington, D. C.), 52, 303-6 (Unavailable) 1960. CODEN: JIECAD. ISSN: 0095-9014.
- AB The properties of electrolytes based on monazite,  $\text{WO}_3$ ,  $\text{Na}_2\text{CO}_3$ , and soda glass in the proportions used by Davtyan, and of other molten

electrolytes are reviewed. Electrolytes comprising Li, Na, and (or) K carbonates were supported in porous sintered MgO disks which are first presintered at 1200.degree.. The electrolyte-impregnated disk is covered on both sides with electrodes consisting of thin layers of metal powders prepd. by redn. of the oxides in **H** or **Co** atms. at temps. slightly above the cell operating temp. Elec. contact is made with Ag, Fe, or Ni wire gauze. Supporting manifolds delivering fuel and oxidizing gas are elec. insulated with mica and asbestos gaskets. Cells of this type ran continuously for several months between 550 and 700.degree. on town **gas**, **H**, **CO**, and natural **gas**.

The best cell had a life of 6 months on town gas and **air** contg. CO<sub>2</sub>. Opencircuit e.m.f. initially 1.1 v. decayed to 0.90 v. and cell resistance increased from an original 0.3 to 1.5 ohms. Cell deterioration was caused by vaporization of alkali oxides and CO<sub>2</sub> and by reaction of the melt with the gasketing. "Drowning" of the electrodes, and electrode deterioration were not factors in the fall of cell output since the MgO disk could be reimpregnated to reproduce, with the same unimproved electrodes, cell performance characteristic of the original cell. Fifty ma./sq. cm. at 0.7 to 0.8 v. were obtained with 50% H and H<sub>2</sub>O on Ni and **air** and CO<sub>2</sub> on Ag electrodes at 600-650.degree.. At 770.degree. 70% CH<sub>4</sub> and 30% H<sub>2</sub>O yield 0, 20, 40, and 60 ma./sq. cm. at 0.98, 0.80, 0.63, and 0.50 v., resp. Ag is an ideal nonpolarizing O cathode in carbonate melts above 500.degree.. The O cathode shows reduced polarization when CO<sub>2</sub> is added to the **O stream**. This fact supports the CO<sub>3</sub>-- mechanism of O transport. The **catalytic** activity of various metals in the anodic oxidn. of CO at 700.degree. was found to be in decreasing order: Pt, platinized Fe or Ni, Fe, Ni, Co, Cu, Cr, and Mn. Electrode particle size influences the results. No satisfactory electrode metal was found for the anodic oxidn. of CH<sub>4</sub> below 750.degree.. When steam is added to the CH<sub>4</sub>, Ni anodes appear suitable.

IT 7440-48-4, Cobalt  
 (anodes, **catalysis** of fuel gas oxidn. by, in  
 fuel cells)  
 RN 7440-48-4 HCA  
 CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 7440-50-8, Copper  
 (anodes, fuel gas oxidn. **catalysis** by, in  
 fuel cells)  
 RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0, Hydrogen

(**fuel cells** with O, with alkali metal  
carbonate electrolyte)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen  
(**fuel cells**, Ag cathodes for)  
RN 7782-44-7 HCA  
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

(**fuel cells**, with alkali metal carbonate  
electrolytes

CC 22 (Electrochemistry)  
IT Gas, **fuel** (manufactured)  
Gas, natural  
(**fuel cells** using, with alkali metal  
carbonate electrolytes)  
IT Alkali metal carbonates  
Alkali metal carbonates  
(**fuel cells** with electrolytes from fused)  
IT Cells, voltaic  
Cells, voltaic  
(**fuel**, with alkali metal carbonate electrolytes)  
IT Anodes and(or) Positive electrodes  
(**fuel-cell**, as **fuel-gas**  
oxidn. catalyst)  
IT Catalysts and Catalysis  
(in oxidn., of CO and CH<sub>4</sub> in **fuel**  
cells, anodes as)  
IT Air  
(mixts. with CO<sub>2</sub>, **fuel cells** using, with  
alkali metal carbonate electrolytes)  
IT Potential, electric  
(of **fuel cells**, with alkali metal carbonate  
electrolytes)  
IT Polarization (electrolytic)  
(of silver in for O in **fuel cells** with alkali  
metal carbonate electrolytes, cathodic)  
IT Cathodes and(or) Negative electrodes  
(silver, for O in **fuel cells**)  
IT Particles  
(size of, of anodes in **fuel cells**,  
**fuel gas oxidn. catalysis** and)  
IT Iron, oxygen in  
(and platinum-coated Fe, anodes, **fuel gas oxidn.**  
**catalysis** by, in **fuel cells**)



- IT Carbon monoxide, dimethyl mercaptole  
Carbon monoxide, dimethyl mercaptole  
(fuel cells using, with alkali metal  
carbonate electrolytes)
- IT 7440-02-0, Nickel  
(and platinum-coated Ni, anodes, fuel gas oxidn.  
catalysis by, in fuel cells)
- IT 7440-48-4, Cobalt  
(anodes, catalysis of fuel gas oxidn. by, in  
fuel cells)
- IT 7440-50-8, Copper  
(anodes, fuel gas oxidn. catalysis by, in  
fuel cells)
- IT 7440-47-3, Chromium  
(anodes, fuel-gas oxidn. catalysis with, in  
fuel cells)
- IT 7439-96-5, Manganese  
(catalysts, in oxidn. of fuel gas in  
fuel cells)
- IT 7440-22-4, Silver  
(cathodes (fuel-cell) from O and)
- IT 124-38-9, Carbon dioxide  
(fuel cells from air alkali metal  
carbonate electrolytes and)
- IT 1333-74-0, Hydrogen  
(fuel cells with O, with alkali metal  
carbonate electrolyte)
- IT 1309-48-4, Magnesium oxide  
(fuel cells with alkali metal carbonate  
electrolytes and)
- IT 497-19-8, Sodium carbonate 554-13-2, Lithium carbonate 584-08-7,  
Potassium carbonate  
(fuel cells with electrolytes contg.)
- IT 7782-44-7, Oxygen  
(fuel cells, Ag cathodes for)
- IT 74-82-8, Methane 7782-44-7, Oxygen  
(fuel cells, with alkali metal carbonate  
electrolytes)

L52 ANSWER (27) OF 27 HCA COPYRIGHT 2003 ACS on STN

57:16049 Original Reference No. 57:3180i,3181a-e High-temperature  
carbonate fuel cells. Broers, G. H. J.;

Ketelaar, J. A. A. (Central Tech. Inst. T.M.O., Hague, Neth.). Fuel  
Cells, Symposium, Atlantic City, 1959, 78-93 (Unavailable) 1960.

AB The properties of electrolytes based on monazite,  $\text{WO}_3$ ,  $\text{Na}_2\text{CO}_3$ , and  
soda glass in the proportions used by Davtyan, and of other molten  
electrolytes are reviewed. Electrolytes comprising Li, Na, and (or)  
K carbonates were supported in porous sintered  $\text{MgO}$  disks which are  
first presintered at 1200.degree.. The electrolyte-impregnated disk  
is covered on both sides with electrodes consisting of thin layers  
of metal powders prepd. by redn. of the oxides in H or  
Co atms. at temps. slightly above the cell

operating temp. Elec. contact is made with Ag, Fe, or Ni wire gauze. Supporting manifolds delivering fuel and oxidizing gas are elec. insulated with mica and asbestos gaskets. Cells of this type ran continuously for several months between 550 and 700.degree. on town gas, H, CO, and natural gas.

The best cell had a life of 6 months on town gas and air contg. CO2. Opencircuit e.m.f. initially 1.1 v. decayed to 0.90 v. and cell resistance increased from an original 0.3 to 1.5 ohms. Cell deterioration was caused by vaporization of alkali oxides and CO2 and by reaction of the melt with the gasketing. "Drowning" of the electrodes, and electrode deterioration were not factors in the fall of cell output since the MgO disk could be reimpregnated to reproduce, with the same unimproved electrodes, cell performance characteristic of the original cell. Fifty ma./sq. cm. at 0.7 to 0.8 v. were obtained with 50% H and H2O on Ni and air and CO2 on Ag electrodes at 600-650.degree.. At 770.degree. 70% CH4 and 30% H2O yield 0, 20, 40, and 60 ma./sq. cm. at 0.98, 0.80, 0.63, and 0.50 v., resp. Ag is an ideal nonpolarizing O cathode in carbonate melts above 500.degree.. The O cathode shows reduced polarization when CO2 is added to the O stream. This fact supports the CO3-- mechanism of O transport. The catalytic activity of various metals in the anodic oxidn. of CO at 700.degree. was found to be in decreasing order: Pt, platinized Fe or Ni, Fe, Ni, Co, Cu, Cr, and Mn. Electrode particle size influences the results. No satisfactory electrode metal was found for the anodic oxidn. of CH4 below 750.degree.. When steam is added to the CH4, Ni anodes appear suitable.

IT 7440-48-4, Cobalt  
 (anodes, catalysis of fuel gas oxidn. by, in  
 fuel cells)  
 RN 7440-48-4 HCA  
 CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 7440-50-8, Copper  
 (anodes, fuel gas oxidn. catalysis by, in  
 fuel cells)  
 RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0, Hydrogen  
 (fuel cells with O, with alkali metal  
 carbonate electrolyte)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 7782-44-7, Oxygen  
 (fuel cells, Ag cathodes for)  
 RN 7782-44-7 HCA  
 CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

(fuel cells, with alkali metal carbonate electrolytes  
 CC 22 (Electrochemistry)  
 IT Gas, fuel (manufactured)  
 Gas, natural  
 (fuel cells using, with alkali metal carbonate electrolytes)  
 IT Alkali metal carbonates  
 Alkali metal carbonates  
 (fuel cells with electrolytes from fused)  
 IT Cells, voltaic  
 Cells, voltaic  
 (fuel, with alkali metal carbonate electrolytes)  
 IT Anodes and(or) Positive electrodes  
 (fuel-cell, as fuel-gas oxidn. catalyst)  
 IT Catalysts and Catalysis  
 (in oxidn., of CO and CH4 in fuel cells, anodes as)  
 IT Air  
 (mixts. with CO2, fuel cells using, with alkali metal carbonate electrolytes)  
 IT Potential, electric  
 (of fuel cells, with alkali metal carbonate electrolytes)  
 IT Polarization (electrolytic)  
 (of silver in for O in fuel cells with alkali metal carbonate electrolytes, cathodic)  
 IT Cathodes and(or) Negative electrodes  
 (silver, for O in fuel cells)  
 IT Particles  
 (size of, of anodes in fuel cells, fuel gas oxidn. catalysis and)  
 IT Iron, oxygen in  
 (and platinum-coated Fe, anodes, fuel gas oxidn. catalysis by, in fuel cells)  
 IT Carbon monoxide, dimethyl mercaptole  
 Carbon monoxide, dimethyl mercaptole  
 (fuel cells using, with alkali metal carbonate electrolytes)

- IT 7440-02-0, Nickel  
(and platinum-coated Ni, anodes, fuel gas oxidn. **catalysis** by, in **fuel cells**)
- IT 7440-48-4, Cobalt  
(anodes, **catalysis** of fuel gas oxidn. by, in **fuel cells**)
- IT 7440-50-8, Copper  
(anodes, fuel gas oxidn. **catalysis** by, in **fuel cells**)
- IT 7440-47-3, Chromium  
(anodes, fuel-gas oxidn. **catalysis** with, in **fuel cells**)
- IT 7439-96-5, Manganese  
(**catalysts**, in oxidn. of fuel gas in **fuel cells**)
- IT 7440-22-4, Silver  
(cathodes (**fuel-cell**) from O and)
- IT 124-38-9, Carbon dioxide  
(**fuel cells** from air alkali metal carbonate electrolytes and)
- IT 1333-74-0, Hydrogen  
(**fuel cells** with O, with alkali metal carbonate electrolyte)
- IT 1309-48-4, Magnesium oxide  
(**fuel cells** with alkali metal carbonate electrolytes and)
- IT 497-19-8, Sodium carbonate 554-13-2, Lithium carbonate 584-08-7, Potassium carbonate  
(**fuel cells** with electrolytes contg.)
- IT 7782-44-7, Oxygen  
(**fuel cells**, Ag cathodes for)
- IT 74-82-8, Methane 7782-44-7, Oxygen  
(**fuel cells**, with alkali metal carbonate electrolytes)

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L53 ANSWER 1 OF 8 HCA COPYRIGHT 2003 ACS on STN BD  
138:371764 **Process** for producing **hydrogen**-containing **gas** by methanol steam **reforming**. Hirose, Shigeyuki; Ikoma, Futoshi; Katagiri, Masayuki; Takamura, Koki; Hiramatsu, Yasushi; Yoneoka, Mikio (Mitsubishi Gas Chemical Company, Inc., Japan). Eur. Pat. Appl. EP 1312412 A2 20030521, 16 pp.  
DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, ~~FR, GB~~, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, SK. (English). CODEN: EPXXDW. APPLICATION: EP 2002-25358 20021114. PRIORITY: JP 2001-354729 20011120; JP 2001-357304 20011122; JP 2001-362284 20011128.

AB There is disclosed a process for producing a **hydrogen**-contg. **gas**, which comprises reacting methanol, steam and oxygen in the presence of a **catalyst** comprising platinum

and zinc oxide, wherein the content of the platinum is in the range of 5-50% by wt. based on the total amt. of the platinum and zinc oxide, or a **catalyst** comprising platinum, zinc oxide and chromium oxide, wherein the at. ratio of zinc to chromium is in the range of 2 to 30, or a **catalyst** comprising platinum, zinc oxide and at least one element selected from the group consisting of lead, bismuth and indium. Each of the **catalysts** has a high activity and is excellent in heat resistance and selectivity to steam-reforming reaction, and accordingly is capable of efficiently producing a **reformed** gas which is composed principally of hydrogen and is well suited for use in a **fuel cell** and the like by means of auto thermal reaction reaction, while lowering the concn. of **carbon monoxide** in a **reformed hydrogen-contg. gas**.

IT 7440-50-8, Copper, uses  
(**process** for producing **hydrogen-contg. gas** by methanol steam **reforming**)

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 7782-44-7, Oxygen, processes  
(**process** for producing **hydrogen-contg. gas** by methanol steam **reforming**)

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 1333-74-0P, Hydrogen, uses  
(**process** for producing **hydrogen-contg. gas** by methanol steam **reforming**)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IC ICM B01J023-60

ICS B01J023-652; B01J023-62; B01J023-644

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 49, 67

ST **hydrogen** contg **gas** manuf methanol steam  
**reforming; fuel cell hydrogen**  
contg **gas** manuf methanol steam **reforming;**  
**catalyst** steam **reforming** methanol **hydrogen**  
contg **gas** manuf

IT Reactors

- (auto-thermal; **process** for producing hydrogen  
-contg. **gas** by methanol steam **reforming**)
- IT **Fuel cells**  
Honeycomb structures  
Steam **reforming catalysts**  
(**process** for producing hydrogen-contg.  
**gas** by methanol steam **reforming**)
- IT Fuel gas manufacturing  
(steam **reforming**; **process** for producing  
hydrogen-contg. **gas** by methanol steam  
**reforming**)
- IT 1314-13-2, Zinc oxide (ZnO), uses 1344-28-1, Alumina, uses  
7439-92-1, Lead, uses 7440-05-3, Palladium, uses 7440-06-4,  
Platinum, uses 7440-50-8, Copper, uses 7440-69-9,  
Bismuth, uses 7440-74-6, Indium, uses 11118-57-3, Chromium oxide  
(**process** for producing hydrogen-contg.  
**gas** by methanol steam **reforming**)
- IT 67-56-1, Methanol, processes 7782-44-7, Oxygen,  
**processes**  
(**process** for producing hydrogen-contg.  
**gas** by methanol steam **reforming**)
- IT 1333-74-0P, Hydrogen, uses  
(**process** for producing hydrogen-contg.  
**gas** by methanol steam **reforming**)
- IT 1302-88-1, Cordierite  
(support; **process** for producing hydrogen  
-contg. **gas** by methanol steam **reforming**)
- L53 ANSWER (2) OF 8 HCA COPYRIGHT 2003 ACS on STN No  
138:139936 Methanol steam **reforming** over Cu/SiC  
**catalysts**. Tomoda, Akihiko; Mikami, Daisuke; Azuma, Naoto;  
Ueno, Akifumi (R7D, FCC. Co., Ltd., Hosoe, Inasa, Shizuoka,  
431-1304, Japan). Journal of Advanced Science, 13(3), 414-417  
(English) 2001. CODEN: JAVSEQ. ISSN: 0915-5651. Publisher:  
Society of Advanced Science.
- AB MeOH steam **reforming** reaction using Cu on SiC as  
**catalyst** was studied for the prodn. of H for **fuel**  
**cells**. **Catalytic** performance (activities, amt. H  
produced, and concn. of CO) were dependent on the calcination temp.  
of the **catalyst**. Calcination at <1073 K in **air**  
leads to an amorphous SiO<sub>2</sub> layer on the surface of the  
**catalyst** which stabilizes Cu active sites against sintering  
during reactions.
- IT 7440-50-8, Copper, uses  
(methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)
- RN 7440-50-8 HCA  
CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 630-08-0, Carbon monoxide, formation  
 (nonpreparative)  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)  
 RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IT 1333-74-0P, Hydrogen, preparation  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)  
 RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

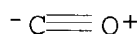
CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 67  
 ST methanol steam **reforming** copper silicon carbide  
**catalyst** hydrogen prodn  
 IT Steam **reforming catalysts**  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)  
 IT 409-21-2, Silicon carbide (SiC), uses  
 (catalyst support; methanol steam **reforming**  
 over copper/silicon carbide **catalysts** for hydrogen  
 prodn.)  
 IT 7440-50-8, Copper, uses  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)  
 IT 67-56-1, Methanol, processes  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)  
 IT 630-08-0, Carbon monoxide, formation  
 (nonpreparative)  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)  
 IT 1333-74-0P, Hydrogen, preparation  
 (methanol steam **reforming** over copper/silicon carbide  
**catalysts** for hydrogen prodn.)

L53 ANSWER ③ OF 8 HCA COPYRIGHT 2003 ACS on STN No  
 137:374279 Method of treating atmospheric pollutants. Morgan,  
 Christopher (Johnson Matthey Public Limited Company, UK). PCT Int.  
 Appl. WO 2002092197 A1 20021121, 24 pp. DESIGNATED STATES: W: AE,  
 AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR,  
 CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU,  
 ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV,  
 MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD,

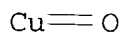
SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN:

PIXXD2. APPLICATION: WO 2002-GB2139 20020515. PRIORITY: GB 2001-11801 20010515.

- AB Atm. oxidizing pollutants such as O<sub>3</sub>, NO<sub>2</sub>, N<sub>2</sub>O<sub>4</sub>, and SO<sub>3</sub> are removed by redox reaction using reducing agents supported on .gtoreq.1 of alumina, ceria, silica, titania, zirconia, or other minerals having large surface area and/or atm. reducing pollutants (e.g. hydrocarbons) trapped on .gtoreq.1 zeolites and other aluminosilicate minerals. The reducing agent comprises a mixt. of CuO and ZnO supported on alumina. The app. is utilized by engines fueled by gasoline, diesel, liq. petroleum gas, natural gas, methanol, ethanol, methane, or a mixt. of .gtoreq.2 of those, by elec. cells, solar cells, and by hydrocarbon or hydrogen-powered **fuel cells**.
- IT 630-08-0, **Carbon monoxide**, uses 1309-37-1, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), uses 1317-38-0, Copper oxide, uses (atm. pollutant removal by redox reaction)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)



- RN 1309-37-1 HCA
- CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)
- \*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*
- RN 1317-38-0 HCA
- CN Copper oxide (CuO) (8CI, 9CI) (CA INDEX NAME)



- IC ICM B01D053-60
- ICS B01D053-66; B01D053-86; B01J023-80; B01J023-72
- CC 59-3 (Air Pollution and Industrial Hygiene)
- ST reducing agent compn **air** pollutant removal redox reaction
- IT Diesel engines
- Electrolytic cells
- Exhaust gas **catalytic** converters
- Particles
- Radiators
- Solar cells
- Soot
- (atm. pollutant removal by redox reaction)
- IT Engines
- (**hydrogen**-fueled; atm. pollutant removal by redox reaction)
- IT 630-08-0, **Carbon monoxide**, uses



1306-38-3, Cerium oxide (CeO<sub>2</sub>), uses 1309-37-1, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), uses 1314-13-2, Zinc oxide (ZnO), uses 1314-23-4, Zirconium oxide (ZrO<sub>2</sub>), uses 1317-38-0, Copper oxide, uses 1344-28-1, Aluminum oxide (Al<sub>2</sub>O<sub>3</sub>), uses 7446-09-5, Sulfur dioxide, uses 7631-86-9, Silica, uses 7784-30-7, Phosphoric acid, aluminum salt (1:1) 9002-89-5, Polyvinyl alcohol 9004-64-2, Cellulose, 2-hydroxypropyl ether 9004-67-5, Cellulose, methyl ether 13463-67-7, Titanium oxide (TiO<sub>2</sub>), uses 28805-15-4, Ammonium polymethacrylate  
(atm. pollutant removal by redox reaction)

- L53 ANSWER 4 OF 8 HCA COPYRIGHT 2003 ACS on STN ~~BD~~ BD  
 137:250326 Combined power/heat plant for **fuel cells** with **fuel** gas manufacturing by steam **reforming** in combination with water gas shift reaction and methanation for **carbon monoxide** removal. Baumann, Frank; Wieland, Stefan; Britz, Peter; Heikrodt, Klaus (OMG AG & Co. KG, Germany). Eur. Pat. Appl. EP 1246286 A1 20021002, 8 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR. (German). CODEN: EPXXDW. APPLICATION: EP 2001-108230 20010331.
- AB A combined power/heat assembly with integrated gas generation system comprises a gas burner-heated steam **reformer** which produces a H<sub>2</sub>-, and CO-contg. **reformat** **gas** flow from a methane/steam mixt. Then the **reformat** **gas** flow is cooled in a heat exchanger and fed into a low temp. shift reactor and thereafter in a methanation reactor for the removal of CO. The purified fuel gas is supplied into the **fuel cell** assembly for the prodn. of elec. power by **catalytic** conversion of the H<sub>2</sub> from the **reformat** with O<sub>2</sub>, whereby the **reformat** **gas** flow is fed to the anodes of the **fuel cell** and the anode waste gas is withdrawn and used for operating the gas burner. The **reformat** **gas** has a methane content of 5-10 vol.% which enables the detection of the gas burner flame with an ionization detector during the combustion of the anode waste gas in the gas burner. The low temp. shift reactor contains a Cu/ZnO-shift **catalyst** and the methanation reactor a Ru **catalyst**. The **fuel cells** with pre-switched gas generation system are suitable for supplying buildings with current and heat a so called combined power/heat plant.
- IT 7440-50-8, Copper, uses  
 (combined power/heat plant for **fuel cells**  
 with **fuel** gas manufg. by steam **reforming** in  
 combination with water gas shift reaction and methanation for  
**carbon monoxide** removal)
- RN 7440-50-8 HCA  
 CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

IT 1333-74-0P, Hydrogen, uses  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
**carbon monoxide** removal)  
RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, **Carbon monoxide**, processes  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
removal of)  
RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM H01M008-06  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
ST fuel gas manufg methane steam **reforming**; anode gas purifn  
**fuel cell**; water gas shift reaction **carbon**  
**monoxide** removal; **reformate** gas methanation  
**carbon monoxide** removal  
IT Methanation  
Water gas shift reaction  
Water gas shift reaction **catalysts**  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
**carbon monoxide** removal)  
IT Fuel gas manufacturing  
(purifn.; combined power/heat plant for **fuel**  
**cells** with **fuel** gas manufg. by steam  
**reforming** in combination with water gas shift reaction  
and methanation for **carbon monoxide** removal)  
IT Fuel gas manufacturing  
(steam **reforming**, app.; in combination with water gas  
shift reaction and methanation for **carbon**  
**monoxide** removal)  
IT Fuel gas manufacturing  
(steam **reforming**; in combination with water gas shift  
reaction and methanation for **carbon monoxide**  
removal)  
IT **Fuel cells**  
(with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for

- carbon monoxide** removal)
- IT 1314-13-2, Zinc oxide, uses 7440-18-8, Ruthenium, uses  
7440-50-8, Copper, uses  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
**carbon monoxide** removal)
- IT 1333-74-0P, Hydrogen, uses  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
**carbon monoxide** removal)
- IT 74-82-8, Methane, uses  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
**carbon monoxide** removal)
- IT 630-08-0, **Carbon monoxide**, processes  
(combined power/heat plant for **fuel cells**  
with **fuel** gas manufg. by steam **reforming** in  
combination with water gas shift reaction and methanation for  
removal of)
- L53 ANSWER 5 OF 8 HCA COPYRIGHT 2003 ACS on STN **BD**  
137:219423 Development of residential PEFC **co-generation/fuel**  
**processor**. Ukai, Kunihiro; Taguchi, Kiyoshi; Tomizawa,  
Takeshi; Fujihara, Seiji (Living Environmental Development Center,  
Matsushita Electric Industrial Co., Ltd., Yagumonakamachi,  
Moriguchi-shi, Osaka, 570-8501, Japan). Enerugi, Shigen, 23(1),  
68-71 (Japanese) 2002. CODEN: ENESEB. ISSN: 0285-0494. Publisher:  
Enerugi Shigen Gakkai.
- AB Development of a residential polymer electrolyte **fuel**  
**cell** (PEFC) cogeneration system with **H2** generators  
using **air** durable **catalysts** is described.
- IT 7440-50-8, Copper, uses  
(fuel processor development for residential PEFC co-generation)
- RN 7440-50-8 HCA
- CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)
- Cu
- IT 1333-74-0P, **Hydrogen**, uses  
(fuel **processor** development for residential PEFC  
co-generation)
- RN 1333-74-0 HCA
- CN Hydrogen (8CI, 9CI) (CA INDEX NAME)
- H-H
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

- ST **fuel cell reforming catalyst**  
residential cogeneration
- IT **Reforming catalysts**  
(fuel processor development for residential PEFC co-generation)
- IT **Fuel cells**  
(polymer electrolyte; **fuel** processor development for  
residential PEFC co-generation)
- IT Fuel gas manufacturing  
(**reforming**; fuel processor development for residential  
PEFC co-generation)
- IT 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses  
7440-50-8, Copper, uses 7440-66-6, Zinc, uses  
(fuel processor development for residential PEFC co-generation)
- IT 1333-74-0P, **Hydrogen**, uses  
(fuel **processor** development for residential PEFC  
co-generation)
- L53 ANSWER 6 OF 8 HCA COPYRIGHT 2003 ACS on STN BD
- 136:311739 Filters contg. pollutant-purification **catalysts**,  
**air** purification apparatus and other commodities employing  
the filters or **catalysts**. Suzuki, Kenichiro; Sofugawa,  
Hideo; Tanabe, Toshiki; Sasaki, Megumi; Morikawa, Akira; Hayashi,  
Hiroaki; Sugiura, Masato (Toyota Central Research and Development  
Laboratories, Inc., Japan). Jpn. Kokai Tokkyo Koho JP 2002119809 A2  
20020423, 18 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP  
2000-315617 20001016.
- AB The filters comprise **air**-permeable main bodies, and  
precious metal **catalysts** loaded on oxide supports; wherein  
the oxides have been previously redn. **treated** to generate  
**oxygen** deficiency. **Air** purifn. app., **air**  
conditioning app., humidifiers, and combustion-type heaters employ  
the filters. Also claimed are elec. fans, deodorants, rubber eraser  
comps., resin comps., spraying app., construction wall materials,  
fiber articles, paper articles, curtains, masks, shoes insoles,  
toilet stools, polymer-electrolyte **fuel cells**,  
CO<sub>2</sub>-contg. gas laser app., and water-decompn. app. in combination  
with ultrasonic wave irradiation for generating H<sub>2</sub>, each of  
them contg. the loaded **catalysts**. The **catalysts**  
are capable of purifying pollutants, such as CO, formaldehyde,  
malodor substances, etc. at ordinary temp.
- IT 1309-37-1D, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), oxygen-deficient, uses  
(**catalyst** supports; pollutant-purifn. **catalysts**  
loaded on oxygen-deficient oxide supports for filters,  
**air** purifn. app., and other commodities)
- RN 1309-37-1 HCA
- CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)
- \*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*
- IT 1333-74-0P, **Hydrogen**, preparation  
(**catalytic** decompn. of water for manuf. of;  
pollutant-purifn. **catalysts** loaded on oxygen-deficient  
oxide supports for filters, **air** purifn. app., and other  
commodities)

RN 1333-74-0 HCA  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, Carbon monoxide, processes  
 (pollutant; pollutant-purifn. **catalysts** loaded on  
 oxygen-deficient oxide supports for filters, **air**  
 purification app., and other commodities)

RN 630-08-0 HCA  
 CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM B01D039-14  
 ICS A61L002-16; A61L009-00; A61L009-16; B01D053-86; B01J023-42;  
 B01J023-63; B01J023-89; C01B003-04; C08L021-00; C08L101-00;  
 D06M011-45; F24F001-00; F24F007-00; H01M008-06; H01M008-10

CC 47-2 (Apparatus and Plant Equipment)

Section cross-reference(s): 38, 49, 52, 59, 63, 67

ST purification filter **catalyst** support oxygen deficient oxide;  
 pollutant purification filter **catalyst** support oxide;  
**carbon monoxide** purification **catalyst** support  
 oxide; acetaldehyde purification **catalyst** support oxide;  
 formaldehyde purification **catalyst** support oxide; **air**  
 purification filter filter **catalyst** support oxide; conditioner  
**air** filter **catalyst** support oxide; combustion  
 heater filter **catalyst** support oxide; elec fan pollutant  
 purification **catalyst** support oxide; deodorant pollutant purification  
**catalyst** support oxide; correction ink pollutant purification  
**catalyst** support oxide; rubber eraser pollutant purification  
**catalyst** support oxide; polymer pollutant purification  
**catalyst** support oxide; spraying app pollutant purification  
**catalyst** support oxide; construction wall pollutant purification  
**catalyst** support oxide; fiber article pollutant purification  
**catalyst** support oxide; paper article pollutant purification  
**catalyst** support oxide; curtain pollutant purification  
**catalyst** support oxide; face mask pollutant purification  
**catalyst** support oxide; shoe insole pollutant purification  
**catalyst** support oxide; toilet pollutant purification  
**catalyst** support oxide; **fuel cell**  
 pollutant purification **catalyst** support oxide; gas laser  
 pollutant purification **catalyst** support oxide; water decompn app  
 hydrogen manuf **catalyst** support

IT Inks

(correction; pollutant-purifn. **catalysts** loaded on  
 oxygen-deficient oxide supports for filters, **air**  
 purification app., and other commodities)

IT Household furnishings

(curtains; pollutant-purifn. **catalysts** loaded on

- oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Materials
  - (erasers, rubber; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Rubber, uses
  - (erasers; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Medical goods
  - (face masks, sanitary; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT **Air** conditioners
  - (humidifiers; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Shoes
  - (insoles; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT **Air** conditioners
  - Air** purification apparatus
  - Deodorants
  - Filters
  - Gas lasers
  - Spraying apparatus
  - Walls (construction)
    - (pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Fibers
  - Polymers, uses
    - (pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Solid state **fuel cells**
  - (polymer electrolyte; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT **Catalysts**
  - (purifn.; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT Toilets
  - (stools; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters, **air** purifn. app., and other commodities)
- IT 65453-23-8P, Cerium zirconium oxide
  - (**catalyst** supports; pollutant-purifn. **catalysts** loaded on oxygen-deficient oxide supports for filters,

- air purifn. app., and other commodities)
- IT 1306-38-3D, Ceria, oxygen-deficient, uses 1309-37-1D, Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), oxygen-deficient, uses 1313-13-9D, Manganese oxide (MnO<sub>2</sub>), oxygen-deficient, uses 1344-28-1D, Alumina, oxygen-deficient, uses 7631-86-9D, Silica, oxygen-deficient, uses (catalyst supports; pollutant-purifn. catalysts loaded on oxygen-deficient oxide supports for filters, air purifn. app., and other commodities)
- IT 7440-06-4, Platinum, uses (catalyst; pollutant-purifn. catalysts loaded on oxygen-deficient oxide supports for filters, air purifn. app., and other commodities)
- IT 7732-18-5, Water, processes (catalytic decompn. of water for manuf. of hydrogen; pollutant-purifn. catalysts loaded on oxygen-deficient oxide supports for filters, air purifn. app., and other commodities)
- IT 1333-74-0P, Hydrogen, preparation (catalytic decompn. of water for manuf. of; pollutant-purifn. catalysts loaded on oxygen-deficient oxide supports for filters, air purifn. app., and other commodities)
- IT 50-00-0, Formaldehyde, processes 75-07-0, Acetaldehyde, processes 630-08-0, Carbon monoxide, processes (pollutant; pollutant-purifn. catalysts loaded on oxygen-deficient oxide supports for filters, air purifn. app., and other commodities)
- L53 ANSWER 7 OF 8 HCA COPYRIGHT 2003 ACS on STN
- 135:274926 Production and storage of hydrogen from methane mediated by metal oxides. Otsuka, K.; Mito, A.; Takenaka, S.; Yamanaka, I. (Department of Applied Chemistry, Tokyo Institute of Technology, Tokyo, 152-8552, Japan). Studies in Surface Science and Catalysis, 136 (Natural Gas Conversion VI), 215-220 (English) 2001. CODEN: SSCTDM. ISSN: 0167-2991. Publisher: Elsevier Science B.V..
- AB A novel method for the storage and prodn. of hydrogen from methane mediated by metal oxides has been proposed. The method combines the catalytic decompn. of methane, the redox of metal oxides and the utilization of the deposited carbon as a chem. feed stock for the prodn. of CO or syngas. The hydrogen recovered through the redox of metal oxides does not contain a trace of CO, thus can be supplied directly to H<sub>2</sub>-O<sub>2</sub> fuel cells.
- IT 630-08-0P, Carbon monoxide, preparation (prodn. of carbon monoxide in storage and prodn. of hydrogen from catalytic decompn. of methane mediated by metal oxides)
- RN 630-08-0 HCA
- CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IT 1333-74-0P, Hydrogen, preparation  
(storage and prodn. of hydrogen from **catalytic** decompn.  
of methane mediated by metal oxides)

RN 1333-74-0 HCA

CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 1309-37-1, Ferric Oxide, reactions 1317-61-9, Iron  
Oxide (Fe<sub>3</sub>O<sub>4</sub>), reactions  
(storage and prodn. of hydrogen from **catalytic** decompn.  
of methane mediated by metal oxides)

RN 1309-37-1 HCA

CN Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) (8CI, 9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

RN 1317-61-9 HCA

CN Iron oxide (Fe<sub>3</sub>O<sub>4</sub>) (8CI, 9CI) (CA INDEX NAME)

\*\*\* STRUCTURE DIAGRAM IS NOT AVAILABLE \*\*\*

CC 49-1 (Industrial Inorganic Chemicals)

Section cross-reference(s): 52

ST hydrogen storage prodn methane **catalytic** decompn metal  
oxide; **fuel cell** hydrogen storage prodn methane  
metal oxide

IT **Fuel cells**

(hydrogen-oxygen; storage and prodn. of hydrogen from  
**catalytic** decompn. of methane mediated by metal oxides  
for)

IT Synthesis gas manufacturing

(prodn. of syngas in storage and prodn. of hydrogen from  
**catalytic** decompn. of methane mediated by metal oxides)

IT Decomposition **catalysts**

(storage and prodn. of hydrogen from **catalytic** decompn.  
of methane mediated by metal oxides)

IT Energy storage systems

(storage and prodn. of hydrogen from **catalytic** decompn.  
of methane mediated by metal oxides for **fuel**  
**cells**)

IT 630-08-0P, Carbon monoxide, preparation

(prodn. of **carbon monoxide** in storage and  
prodn. of hydrogen from **catalytic** decompn. of methane  
mediated by metal oxides)

IT 1333-74-0P, Hydrogen, preparation

(storage and prodn. of hydrogen from **catalytic** decompn.  
of methane mediated by metal oxides)

IT 74-82-8, Methane, reactions 1309-37-1, Ferric Oxide,  
reactions 1312-43-2, Indium Oxide 1317-61-9, Iron Oxide  
(Fe<sub>3</sub>O<sub>4</sub>), reactions

(storage and prodn. of hydrogen from **catalytic** decompn.  
of methane mediated by metal oxides)



L53 ANSWER (8) OF 8 HCA COPYRIGHT 2003 ACS on STN

135:7526 Method of starting and stopping methanol **reforming** apparatus and apparatus for supplying fuel to said apparatus. Naka, Takahiro; Sumi, Hideaki; Furuyama, Masataka; Isobe, Shoji; Hiramatsu, Yasushi; Yoneoka, Mikio (Japan). U.S. Pat. Appl. Publ. US 20010002043 A1 20010531, 17 pp. (English). CODEN: USXXCO. APPLICATION: US 2000-725808 20001130. PRIORITY: JP 1999-341442 19991130; JP 1999-341443 19991130; JP 1999-341444 19991130.

AB The present invention presents: (1) a starting method that is capable of quickly switching to the **reforming** process after warming up a **catalyst**; (2) a fuel supplying app. that is capable of maintaining a stable supply of a mixed water-methanol soln. while preventing water from freezing in a cold climate, and is also capable of immediately supplying a mixed water-methanol gas that has a compn. which is outside of the high-rate reaction region during the starting/stopping operation of the **reformer** when the control tends to be unstable; (3) a method to quickly cool down a **catalyst** layer without causing thermal runaway when stopping the operation of the methanol **reforming** app.; and (4) a method to quickly cool down the **catalyst** layer while preventing thermal runaway from occurring and removing residual fuel when stopping the operation of the methanol **reforming** app. In order to achieve the objects described above, the methanol **reforming** app. that generates a **hydrogen-rich gas** by reacting a mixed gas of water, methanol and **air** on a **catalyst** is supplied with the fuel from a fuel supplying app. comprising a mixed water-methanol soln. tank wherein the molar ratio of water and methanol used for **reforming** is controlled to a predetd. value, a mixed water-methanol soln. tank wherein the molar ratio of water and methanol is controlled to .gtoreq.4.6, and a switching means that switches the mixed water-methanol soln. tank used as a fuel source according to the conditions of operation of the methanol **reforming** app.

IT 7440-50-8, Copper, uses 7782-44-7, Oxygen, uses  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

RN 7440-50-8 HCA

CN Copper (7CI, 8CI, 9CI) (CA INDEX NAME)

Cu

RN 7782-44-7 HCA

CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IT 1333-74-0P, Hydrogen, preparation  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

RN 1333-74-0 HCA  
CN Hydrogen (8CI, 9CI) (CA INDEX NAME)

H-H

IT 630-08-0, **Carbon monoxide**, processes  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

RN 630-08-0 HCA  
CN Carbon monoxide (8CI, 9CI) (CA INDEX NAME)

-C≡O+

IC ICM A61L009-00  
NCL 252373000  
CC 49-1 (Industrial Inorganic Chemicals)  
Section cross-reference(s): 52

ST methanol **reforming** app operation **fuel**  
**cell** hydrogen manuf

IT Fuels  
Heat exchangers  
Process control  
Process dynamics

**Reforming**

Steam **reforming catalysts**

(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

IT **Reforming** apparatus  
(steam; method of starting and stopping methanol  
**reforming** app. and device for supplying fuel to the app.)

IT 7429-90-5, Aluminum, uses 7440-50-8, Copper, uses  
7440-66-6, Zinc, uses 7782-44-7, Oxygen, uses  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

IT 1333-74-0P, Hydrogen, preparation  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

IT 67-56-1, Methanol, processes 7732-18-5, Water, processes  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)

IT 630-08-0, **Carbon monoxide**, processes  
(method of starting and stopping methanol **reforming**  
app. and device for supplying fuel to the app.)